JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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VOL. XCIX., No. 2306.—TUESDAY, JULY 23, 1907.

EDITORIAL NOTES—GAS, &c.

London County Council and Meter-Rents.

IT is a common belief of a section of the community that private companies exercising a public service consider nothing but their own selfish ends. It is a mistake; but if there were real ground for the belief, that ground would serve as the altar upon which selfish interest would be sacrificed. For long years the gas industry of the Metropolis was treated by the late masters in local government with open suspicion, and no good thing could be seen in any act that originated with the Companies. It is therefore with considerable pleasure that we note the, generally speaking, courteous tone that ran through the debate in the County Council on the report of the Public Control Committee dealing with the re-imposition of meter-rents by the Gaslight and Coke Company. The report (as indicated last week) treated of the subject in the practical way that a proposition supported by reasonable considerations, and coming from a body of business men, deserves. Notwithstanding the subsidence from power to impotence of a certain part of the representation in local government in the Metropolis, it was anticipated that the proposal would not go through without a little show of rancour, or (shall we say?) resentment, on the part of the enemies of private enterprise; and from here and there in the Council Chamber, the old note was heard. But it was the old note much weakened by party adversity. It was that the Company had some other motives up their sleeves than those expressed. Crafty and plausible Company! Consumers would suffer; and the Company gain therefrom. So spoke those whose avowals make us doubt whether they know "a hawk from a handsaw." Let us see.

The Company by the agreement in effect concedes a penny of their standard price; there will thus be an absolute necessity for utilizing the revenue from meter-rents in keeping the price of gas a penny lower than it would otherwise be, in order that the dividend may not be affected by the concession; there is the pledge not to raise the price of gas for a twelvemonth; the great body of prepayment consumers (who would have to bear their share of an increase in the price of gas) will not in any wise suffer; and there will be the production of a definite revenue (through re-establishing meter-rents) from thousands of consumers who have meters as stand-bys, or who consume so small a quantity of gas that their custom is hardly worth troubling about, and which revenue spread over the ordinary business will act beneficially to the general body of consumers. In these considerations are concentrated the advantages to the consumers of the restoration of meter-rents. Alderman Anstruther, the Chairman of the Public Control Committee, was right in saying that a permanent benefit, by the course the Company were taking and the arrangement entered into with them, had been secured to the consumers of gas in London. But whose particular interests is Mr. Will Thorne, M.P., seeking to serve in giving notice to raise in the House of Commons this question of meter-rents? Are they those of the small consumers and stand-by meter users of the West-end? If so, Mr. Thorne is proving unfaithful to the trust reposed in him at the last General Election, when labour, the patron of the prepayment meter gas system, carried him on the top of the tide to Westminster. To assist in producing equality between the different classes of gas consumers and so benefit the poorer ones, Mr. Thorne should throw in his lot with the Gaslight and Coke Company (who will be supported by the County Council), when the trial of strength comes with the City over its "favoured nation clause" in regard to meter-rents.

On learning of the successful half-year's business the Company have just closed, there will be some among the critics who will be disposed to question the necessity for rehabilitating the meter-rents; but a few facts should convince them to the contrary. The amount which will be carried forward, after paying the six months' moderate dividend, will be £306,992; but of this £229,953 represents the accumulations brought into the half-year's accounts. The reinstatement of meter-rents will only produce £60,000 a year; and our calculation is that the more expensive raw material the Company will be using in the twelve months from now, will cost them something like an additional quarter-of-a-million. The Company operate in big figures; but an extra outlay of a quarter-of-a-million has to be provided from some source. The Company are really dealing wisely and diplomatically with London in this matter; and they have no ulterior motives, such as were hinted at by one or two narrow-minded County Councillors. The Company's cards are all on the table; and a majority of the Council saw them and their import.

Municipal Trading Accounts.

THE Departmental Committee's inquiry into the question of municipal accountancy has been completed; and, on the whole, the choice made by Mr. John Burns of a Committee to whom reference of the intricate questions involved could be made, has been abundantly justified. There are among the conclusions of the Committee those in which it would be perfectly easy to pick holes. But they are few; and so it follows that, in the main, the report will, if accepted, do much to clear away the crookednesses, contractions, and ambiguities in the fiscal statements and policy of many of our local authorities. This can well be done by the aid of simplification and unification, so far as the latter is possible under the variation of condition. Ratepayers ask for light on their towns' revenues and expenditures; and it is right that they should have it in the purest and strongest form possible. That they have been allowed in all cases the right of knowing how their affairs are managed, the Committee inferentially question through their conclusion that the accounts of municipal authorities are not kept on any uniform system. The Committee are lenient in attributing this condition of things to the vague terminology of Acts of Parliament, insufficiently precise regulations and definitions, and the increasing sense of the inadequacy of the purely cash system of keeping accounts. We cannot, however, hold local authorities altogether blameless in this matter; for Local Government Board inquiries have revealed malversation of a very deliberate character in accountancy, and solely indulged in for the benefit of the trading undertaking concerned. From these and other findings of the Committee, one can readily comprehend why the ratepayers have not found the statements of local finance altogether intelligible, and also why returns—so-called "official" returns—have not been found consistently reliable.

The Committee advise that the most efficient system of account-keeping for general application to local authorities is a system of income and expenditure, on which all incomings and outgoings pertaining to any given period, whether actually received and disbursed or not, are included in the accounts of the period. That conclusion is really the capital one in the report; but it is among the details of the recommendations that amendment must be sought for. The actual scheme of book-keeping must necessarily be adapted to the requirements of the several local authorities; but we do most heartily agree with the Committee that the scheme should be designed to present the accounts of the various transactions through their different stages from first to last in a continuous and coherent connection. The Committee also recommend that separate revenue accounts, net revenue accounts, and balance-sheets should be prepared in respect of all trading undertakings. That, again, is a matter that Parliament has sought to assure in Private Acts referring to these undertakings; but "vague terminology," anything but "precise regulations and definitions," and liberal interpretation have kept open the door to peculiar and irregular allocation of charges as between department and

department. That is a practice against which protection is badly needed. The Committee take a narrow view of the much-disputed question of depreciation. It is agreed that the variable nature of assets precludes the application of any general standard or scale of depreciation. The point on which the Committee will find themselves at variance with expert financiers, but supported by "Progressively" directed Councils, with profitless or next to profitless trading undertakings, and by the gentry who are always in search of something in aid of the rates, will be this: "The repayment "of debt, so far as it goes, may properly be regarded as pro- "vision for depreciation. But it is possible that the period "allowed for repayment may be excessive; and therefore in "some cases further provision for depreciation may be neces- "sary." Though the Committee assert that "repayment of "debt so far as it goes may properly be regarded as provision "for depreciation," we find in all the proffered standard forms of accounts for gas, electricity, water, and tramways accompanying the report, that a renewals fund account is presented. On this question of depreciation or provision for renewals the Committee appear to have tried to avoid the sand-banks raised by past controversy by steering a middle course. These renewals funds are, at the option apparently of a local authority, to have a full or limited application. Within the Committee's knowledge, there are evidently many authorities with plant already scrapped, but the loans for which are undischarged; for it is advised in the report that replacements should be set against revenue or reserve fund in all cases, "except where the original loan "has been discharged, and a further loan sanctioned." Now, if all replacements were charged to a renewals or depreciation fund regularly provided from revenue, ratepayers would not be perpetually engaged in that unprofitable business of working in respect of the same plant on borrowed money, with its continuous burden of interest and sinking fund. The special points submitted by the Committee for the making of regulations are of interest; and it is open to all to subscribe heartily to their deliberate opinion, that the regulations should aim at securing that reliable and uniform principles shall in all cases govern the statement of profit and loss.

As intimated, the Committee append to their report proposed standard forms of accounts for municipal trading concerns. The completeness or otherwise of these cannot be judged by hasty inspection; but so far as the gas-works accounts go, while naturally they follow in their substance the "Model Form of Accounts" appended to the Gas-Works Clauses Act, 1871, there are a few variations apart from those necessitated in conforming the accounts to the needs of local authorities. It will be observed that wages of stokers and of purifying men are set out under the separate employments, instead of being lumped together. But as there are more than stokers and purifying men engaged on a works, we are wondering where, under this specific division, their wages are to be charged up. Another charge quite out of the ordinary, but nevertheless useful on the expenditure side of the account, is "Residual Products—Charges in Connection "Therewith." It is also seen that the payments for gas by municipal departments are to be kept distinct from those of private consumers. We hope that good will ensue from the Committee's labours, by the attainment of those purposes which will give greater satisfaction and confidence in municipal accountancy than exist at the moment. Nothing more important touching this subject has appeared since the Joint Select Committee on Municipal Trading reported in 1903.

Speculative Electricity Charges.

THE Incorporated Municipal Electrical Association were partly engaged at their recent meeting at Sheffield in considering a couple of papers bearing upon, but not helping to assuage, the much-vexed question of charging for electricity. We are not going to discuss the papers, but merely refer to the sidelight they and the discussion threw on the subject covered by the title adopted above. The authors of the papers were Mr. H. K. Burnett, of Barrow-in-Furness, and Mr. C. E. C. Shawfield, of Wolverhampton—the one discoursed on "The Relation of Costs to Scales of Charges," and the other on "Cheap Power Supply by Municipalities." The compositions were remarkable—the chief characteristic in one case being the beautifully elementary matter; in the other, the tactless and buoyant spirit in which the author advised that business should be done. But both communications were representative, in an extraordinary manner, of the principles that have guided many electrical engineers in devising their scales of charges. Simple faith, recklessness, and indiscrimination underlie many a tariff of charges for electricity. Mr. Burnett presented considerations, not all acceptable, but some that should be of radical importance in drawing up a tariff; Mr. Shawfield advocated that the element of prudence in business should be scattered to the four-winds, adopting as his maxim "Adjust the tariff to suit the "competition; and the cost of production will adjust itself to "the tariff." Pliant cost of production! Did ever anyone see such a fantastical rule advocated for serious business? The maxim points out the high road to financial disaster. Nevertheless, it is the maxim that, consciously or unconsciously, has been—we have, in addition to our own knowledge, published electrical authority for saying this—adopted in the electrical industry; and if the results have in isolated instances been successful, it has been by sheer good luck, and not because the methods summed up in the maxim comprehend intelligence, commercial aptitude, prudence, foresight, and the ability to direct on commonsense and systematic lines. We would put a shorter maxim alongside Mr. Shawfield's—"Look before you leap;" and consider it in conjunction with Mr. J. F. C. Snell's very practical remarks in the discussion on the papers. Mr. Snell said (quoting the "Electrician" report):

> **From his more recent experience of power supply in many large towns, if the tramway load continued to increase, it would not be possible to cover the cost, if supplying at a cheap rate. He thought the tendency was away from many different methods of charging towards a uniform system of initial charge, with graduated scale of discounts. The moral to be drawn from the papers was that the competition with gas for lighting was becoming more keen; and, although there was also power competition, this could be more successfully met. In fixing power tariffs, however, it was** ***necessary to keep in mind the rapid rate at which the power load was increasing. If this factor were left unconsidered, the power load might preponderate over the lighting, and the revenue account might appear on the wrong side.***

A perfect sermon could be prepared for electrical engineers with Mr. Snell's warning words as the text. There are power loads and power loads. There are large, constant, and long-hour power loads that are worth having, and that have a remarkable influence upon costs generally; there are other loads that are erratic in time and quantity—such as some of the London Companies have taken on—that are not worth having, and that are a burden on the lighting consumers. In some towns the greater part of the power load is built up of such as these. In considering some of the low-priced contracts for power electricity that have come to notice, where the load is dependent on the fluctuations in the demand for the manufacturers' goods, we have marvelled at the boldness of the business-at-any-price engineers. We see no reason why it should not come to pass in some towns for the electrical power business to, as Mr. Snell puts it, preponderate over the lighting business, and the lighting become merely a kind of side-issue to the main or power part of the business. Brighton reports a drop of nearly 78,000 units last year in private consumption—largely (so it is said) due to the high-efficiency electric lamps, and we with all modesty claim that the part of this decline in consumption that is not due to the high-efficiency electricity lamps is attributable to consumers returning to incandescent gas lighting. Should the power business ever swamp the lighting business through the influences acting in both directions, then we shall read some lessons from financial statements which will be the unwelcome product of present speculative and unreasoned fixing of charges.

We are rather surprised to find Mr. S. L. Pearce, of Manchester, ranking himself with those of the speculative school. "There are," he says, "cases in which the authority would "be justified in remitting a portion of the fixed charges for "power consumers; and this would probably be sound policy "for the undertakings as a whole, though it might result in "a loss for a year or two on that particular consumer." It is impossible to subscribe to these unbusinesslike doctrines, especially in connection with a municipal concern. Where there is loss, someone has to bear it, and, in a municipal concern, it is not the management (the management not being the investing principals as in a private concern), and it is not those who lend the capital for the business (they are fully protected). Then it must be those consumers whose custom produces profit; or, if their profit is not in the aggregate equal to the satisfying of the financial obligations of the concern, then the loss resulting from such wanton trading falls on the ratepayers who have not contributed to the making of the loss. That either the profit-making

consumers or ratepayers should bear such loss is an indefensible proposition. The loss, Mr. Pearce lightly suggests, might have a duration of only a year or two; we submit that it might also be perpetual, so long as the particular contract lasted. And such speculation, we hold, ought to be ousted from municipal trading. More of this kind of business is found in Mr. Burnett's reply upon the discussion. "They "could not," he remarked, "help losing over the short-hour "consumers; and they must therefore increase the profits "on the long-hour consumers, or the net result would be on "the wrong side." Well, it is a queer sort of business that penalizes the best consumers for the worst ones; and they must be queer sort of people who manage such business. However, it is a pleasure to see that our electrical contemporaries, in commenting upon the papers, decline to be parties to such uncommercial tactics, and deal with the matter in a more sober spirit than the two authors concerned and some of the participants in the discussion on the papers. We cannot help thinking that, if the Council of the Incorporated Municipal Electrical Association are not desirous of making the administration of the electrical industry the laughing-stock of competitors, they will discountenance such papers as these in future, and adjure their members, when speaking in discussions, to keep in the background certain of the idiosyncrasies of electrical commercialism.

Putting on the Hands of the Clock.

THERE are schemes which at the first blush strike one as quixotic, but which on further serious consideration may prove theoretically correct and practicable under certain conditions. A scheme propounded by Mr. William Willett, of Sloane Square (which is, however, by no means novel), is one of these; but that scheme has been "laughed to scorn" by the "Westminster Gazette," as the work of a visionary and as absolutely impracticable. The douching of ridicule that our evening contemporary gives the idea amuses, but it has not so much weight as an actual demonstration of practicability. What Mr. Willett proposes is that we should utilize more of Nature's light, and less of the artificial variety by, in April, putting on the hands of the clock for four successive Sunday mornings by twenty minutes; and thus by May we should be rising 80 minutes earlier in the daylight, and be retiring 80 minutes sooner after darkness had set in. Then, on the same instalment principle, he would have us go back to the old times in September. Mr. Willett maintains that in this manner we should obtain the maximum of health, strength, entertainment, and would economize in our use of artificial light. That is where the lighting industries would look askance at the scheme. "Everyone, rich and poor "alike, will find his ordinary expenditure on electric light, "gas, oil, and candles considerably reduced for nearly six "months in every year, so that 210 additional hours of day-"light can be gained, and at least £2,500,000 a year can be "saved to the people of Great Britain and Ireland." The details of this estimate are not available; so that we cannot discuss Mr. Willett on the head of the saving. But however the figure has been arrived at, it can only be a supposititious one.

A very similar, but permanent, project to Mr. Willett's was actually put into force, to the extent of an hour, in Cape Colony a few years ago. People on an appointed day put their clocks on an hour, so (according to the old time) starting the day an hour earlier, and ending business an hour sooner, and retiring to rest at their customary hour by the new time. That it did have an effect on the consumption of gas, though not to the extent that might have been anticipated, was a point in Mr. D. Ford Goddard's address to the shareholders of the South African Lighting Association in 1904. Cape Colony then proved the practicability of the idea. We prove the same thing by the adjustment of our chronometers, and the regulation of our movements to the altered time, on every occasion we visit the Continent or Ireland. The weak point, however, in Mr. Willett's mode of procedure in bringing the alteration to pass is the suggestion of the instalment system. He wants to do the thing gently; but we cannot be chopping and changing about eight times a year, disorganizing business, traffic, industry, and everything else with each change. There would be difficulty in conforming pace and habits to such rapid mutation. If a change is made, it must be once and for good. In the depth of winter, it would really make little difference whether we used artificial light for eighty minutes in the morning, and lessened it by the same time in the evening. The gain would be in the summer months. Such a change would, of course, have to be universal, and Parliament would have to make it compulsory. But Parliament is at present too busy with other matters; and nobody but Mr. Willett seems dissatisfied with the present time regulation of the day's affairs. Therefore, the lighting industries need not fret just yet over a prospective loss of business through the pictured economy of this revolutionary dream.

Liability for Stamp Duty.

The question of the liability of companies to pay an *ad valorem* stamp duty when passing from a non-statutory to statutory estate has been submitted to the arbitrament of Mr. Justice Bray, and he sides with those eminent Counsel who have given their opinion that such liability does exist, although equally eminent Counsel have pronounced the other way. The *pros* and *cons* of the matter have been previously submitted in these columns; and our sympathies have been on the side of the aggrieved companies. The contention of the Commissioners of Inland Revenue is that there is, on the obtaining of an Act of Parliament by a non-statutory company, a vesting of the property of the limited company in the new company "by way of sale," and therefore the provisions of the Finance Act of 1895 apply. On the other hand, it is contended by the companies who have contested the question that the conferment of statutory powers merely raises the status of the existing limited company, and there is no transaction in the nature of a sale—the parties being identical, and not contracting parties. It is purely a question of legal interpretation; and in the King's Bench Division, Mr. Justice Bray is in favour of the Inland Revenue Commissioners. There the matter stands; and no good purpose would be achieved by further discussing the matter here, unless the companies interested are prepared to carry it farther. That they will be prepared to do so is hardly likely, as the additional expense would fall upon them, and, if success attended their efforts, the gain would be that of future non-statutory companies on their incorporation. In the presentation of the matter for adjudication by the Court, the Felixstowe Gas Company have taken a leading part; and in furthering the matter Mr. F. Paternoster, the Company's Engineer and Manager, has been the active mover, with the concurrence of his Board.

Testing Dublin Gas.

After the lapse of some weeks, to enable one of the Divisional Magistrates—Mr. Swifte, K.C.—to consider the evidence submitted to him in connection with three summonses taken out by the Dublin Corporation against the Alliance and Dublin Consumers' Gas Company for supplying gas which was alleged to be below the standard illuminating power, and also to afford him an opportunity of inspecting the gas-testing station, he has delivered his judgment, and the principal points of it will be found in our "Legal Intelligence." In two out of the three cases of alleged deficiency, the Corporation failed to substantiate their charges against the Company, and they were ordered to pay £20 costs in respect of each summons. In the third, the Company admitted that their gas was below the standard, as the result of an accident; and they were fined £1, with £4 costs. The whole case turned, it may be remembered, on the reliability of the tests made by Mr. Thomas J. Cotton, the Official Gas Examiner to the Corporation, which was disputed by the defendants. Seeing that when the late Professor Tichborne, the Gas Examiner under the Board of Trade, tested the gas, his figures were invariably higher than those of the Corporation's Examiner, and that Professor Lewes gave evidence to the effect that the method of testing employed by the latter official was calculated to render his results worthless, the Magistrate had only one course to follow. While acknowledging Mr. Cotton's "great conscientiousness" in the discharge of his duty, Mr. Swifte thought he adhered too rigidly to opinions formed many years ago, and now in some respects superseded. It is to be regretted that before the Company were dragged into a Police Court the evidence to be brought against them was not carefully scrutinized in the light of previous the differences between the Official Gas Examiner and a photometrist of the standing of the late Professor Tichborne, as the Corporation would then have been spared the unpleasantness of hearing Professor Lewes's frank opinion. Another matter for regret is that, in view of the technical nature of the case, the Magistrate could

not have had the assistance of an assessor, as then possibly the inquiry might have been shortened. However, it may be hoped that the relations between the parties may henceforward be such as to require the intervention of neither legal nor technical experts. We are sure this condition of things is heartily desired on the Company's side.

Gas Affairs in Manchester.

Once more the report and accounts of the Manchester Corporation Gas Committee—the usual particulars from which we are, by the courtesy of Mr. Charles Nickson, the Superintendent, able to publish to-day—testify to a highly successful year's working. There has been a considerable expansion in the amount of business done; for the quantity of gas sent out from the works shows an increase of just over 5 per cent. above the preceding twelve months, which in its turn was nearly 6½ per cent. above the year before. In the manufacture there is also an advance of a gratifying character to chronicle, inasmuch as the make of gas per ton is on the present occasion over 100 cubic feet greater—the increase having been from 10,976 to 11,099 cubic feet per ton. The quantity of gas consumed by cookers was last year over 18 per cent. more than in the preceding twelve months; and at the present time about 39 per cent. of the Corporation consumers have the free use of a cooker or griller. Curiously enough, while the number of gas-engines in use has fallen from 1775 to 1732, the amount of gas taken for this purpose shows an increase of about ½ per cent. Cookers now account for a consumption of 504 million cubic feet; and gas-engines, 416¼ millions. Coming to the financial aspect, it is seen that the net profits have increased from £91,337 to £120,123. The amount handed over to the rates is a few hundred pounds more on this occasion than was the case last year—the contribution being the very round (not to say princely) sum of £60,000. While the income of the department has gone up from £699,566 to £730,902, the expenditure has exhibited quite as gratifying a movement in the other direction—the falling off having been from £566,692 to £564,304. Taking the biggest item of expenditure—coal, cannel, and oil—the cost per ton was very nearly 5d. less than in the preceding twelve months, which, it is pointed out, on the total carbonization of 503,693 tons, amounts to £10,347. For the purpose of the apportionment which the Committee have made, a sum of £8782 has been transferred from the reserve fund and added to the net profit—a very much smaller sum than was similarly transferred last year, when also the purchase-money for the portion of the Stretford Gas Company's undertaking that was acquired was taken from the reserve.

A Strange Case at Bradford.

Very seldom indeed can it have been the lot of a corporation official to be so severely handled as was a clerk in the legal department of the City of Bradford last week by Mr. Justice Grantham, as the outcome of a case tried at the West Riding Assizes. The action (a report of which will be found in another part of this issue) was one to recover the value of stationery, &c., alleged to have been damaged on the premises of a draper by leakage of water through crevices left round a flagstone which had been raised by the Corporation workmen for the purpose of finding a gas escape, and then loosely put back into position. The evidence given was for the most part of a highly conflicting character; witnesses being called for the defence who said they had seen one of plaintiff's men himself lifting up the flagstone, and that the plaintiff had purposely caused damage to be done to his stock for the bolstering up of the claim. Thus the Jury were confronted with the plain question of which side was telling the truth; and in the settling of this, material assistance was rendered by Mr. Tindal Atkinson, plaintiff's Counsel, in his cross-examination of two of the witnesses called for the Corporation. Both of the men in question were formerly in the employ of the plaintiff; and each swore that the stock had been tampered with for the purpose of increasing the claim for damage. They were, however, forced to admit in cross-examination that they made statements to plaintiff's Solicitor of conversations they had had with a clerk in the service of the Corporation; and these statements were, as will be seen from the report, of a most extraordinary character—showing, as they did, that the men had been seriously tampered with. This fact it was that led Mr. Tindal Atkinson to give expression to the thought that when the ratepayers of Bradford read an account of the case, "they would blush for shame that such conduct could be pursued by a Corporation official;" and this fact, also, it was that drew from Mr. Justice Grantham a most scathing criticism when summing up the case to the Jury. His Lordship's remarks could not well have been stronger; and the Foreman of the Jury was requested by his colleagues to express their agreement with what had been said. The matter is now under investigation by a Special Sub-Committee of the Finance Committee, who will no doubt probe it to the bottom. Admitting the need for taking every precaution against claims for damages being unduly swelled, still zeal should be tempered by discretion—which, judging from what transpired at the Assizes, has not been the case in the present instance.

Sulphate of Ammonia Committee's Report.

The meeting of the subscribers to the Sulphate of Ammonia Committee has been held; and extracts from the report of the Executive appear in our "Miscellaneous News." The activities of the Committee have not during the past year been lessened. There was, it is true, a diminution in the number of prize competitions; but the cause of this is satisfactorily explained. It is, on the other hand, gratifying to see that special effort has induced 25 other Agricultural Societies who have not hitherto competed to enter the competitions this year. Display was made at several exhibitions; and propagandizing work in other directions has been continued at the same high level as formerly. The representative of the Committee specially appointed for the purpose last year has been doing good service by personal interviews in securing co-operation in developing the sales of sulphate of ammonia. Several new subscribers were obtained during the year; but the report does not tell us the classes of producers these represent—whether for undertakings or otherwise. Tables extracted from the report of the Technical Adviser will show readers the considerable increase in crop yield per acre obtained in the competitions on land receiving a dressing of sulphate of ammonia.

Electrolysis.

Protection of underground pipes against electrolytic action, and the safety of the public, are obviously matters of small moment to the Lord Chairman of Committees. His Lordship is the impassable barrier in this matter. Although there may be agreement between promoters of electricity measures and pipe owners, and although the Commons may grant protection, Lord Onslow exercises his prerogative with merciless pen, and strikes out any provision referring to the matter. We should dearly like to know the reason for this high-handedness. Only the other week allusion was made in the editorial columns to the insertion in the North Metropolitan Electric Supply Company's Bill, by a Committee of the Commons, of a protecting clause for the Metropolitan Water Board. The Lord Chairman has now struck out the clause. He had not heard the evidence; the Commons Committee had.

Cost of Old-Age Pensions.

Some further material has been offered towards a solution of the vexed problem of what would be the cost of instituting in this country a system of old-age pensions such as is dear to the heart—or so it is claimed to be—of the up-to-date politician. Whatever may be the cost of any scheme that may be finally brought into force, it will have to be paid in some manner or another, and therefore the topic is one of general interest, not alone to those who look to benefit from its provisions. It has already been argued that the money required to finance any such proposal must be a gigantic sum; and the figures just issued by the Local Government Board in the shape of a Blue-Book do nothing towards altering this view. There is given a series of tables relating to the population, &c., and a memorandum giving a summary of the schemes considered by various Committees. The age generally agreed upon at which persons would become qualified to receive a pension is 65 years (the limits fixed by the statutes governing State pensions at the Antipodes); and the number of persons of this age and over in the United Kingdom at the present time is estimated at 2,116,000. To grant a pension of 5s. a week—an amount which can hardly be considered as sufficient to serve any real purpose—to all persons of this

age without distinction would therefore require £27,508,000; and some idea of what this means may be gathered from the fact that it would be equivalent to a tax of about 12s. 6d. per head on the total estimated population. Of course, the cost would be largely reduced if a limit of income for those eligible for pensions were fixed, as has often been suggested. If from the total already given were deducted those whose incomes exceed 10s. a week, and also paupers, aliens, and persons with other disqualifications, the number, it is calculated, would be reduced to 686,000, or 32·4 per cent., of the population over 65 years of age. But there are at any rate two possible objections to be urged against the provision of any discriminating scheme. In the first place, it would seem to some extent to place a premium on unthriftiness; and, in the second, it might have the appearance at all events of being only another form of charitable relief. In any event—even if no limit of income were fixed as entitling persons to a pension—there would, of course, be a large number of people who would not apply for their 5s. a week; and to this extent the estimated cost would be modified. This "Blue-Book" pronouncement, however, is sufficient to give an idea of what old-age pensions will mean, and to afford scope for reflection on the other side of the question—that relating to the finding of the money.

Workmen's Compensation Statistics.

As an outcome of the resolution passed by the Institution of Gas Engineers at Dublin (requesting the Council to appoint a Committee to consider the question of insurance under the Workmen's Compensation Acts), Mr. Hanbury Thomas, the General Manager of the Sheffield United Gaslight Company, forwards a letter, which we have much pleasure in publishing, giving the experience of his Company with regard to a scheme instituted at the time of the passing of the first Act. Under this, there was set aside a sum equal to 6s. 8d. per cent. on the total wages paid by the Company; and after 8½ years' working there was a sum in hand, after the settlement of all claims, of £709, out of the £2509 placed to the fund—the claims paid having amounted to £1798, equal to 4s. 9·29d. per cent. on the wages. Had, however, the provisions of the 1906 Act applied, the compensation would have amounted to £2286, or 6s. 0·84d. per cent. on the wages paid; and the balance remaining in hand would have only been £223. As this would not have been sufficient provision for any disastrous accident, the Board have decided, as from the 1st inst., to increase the sum set aside from 6s. 8d. to 8s. per cent. on the total wages paid, which it is thought will make matters about the same as they were with the lower percentage under the old Act. Mr. Hanbury Thomas points out that compensation for machinery accidents has only accounted for 5·43 per cent. of the total paid; and his statistics bear out the contention of Sir George Livesey that the larger proportion of accidents happen to the younger men—age bringing with it greater care and steadiness at work. A report by Mr. W. R. Herring, of Edinburgh, on the same subject is noticed in our news columns.

Mr. H. E. Jones on the Continental Gas Engineer.

Certain remarks made by Mr. H. E. Jones at the meeting of the European Gas Company may escape the observation of some professional readers if not given a little more prominence than they obtain in the rear part of the report of the proceedings at that meeting. The remarks were very flattering to the Engineers of the Company; but as they also involved comparison, they may be read with mixed feelings by professional gas engineers in this country, among whom, it must not be overlooked, is Mr. Jones. He was seconding a vote of thanks to the officers of the Company; and he said the staff of the Company was filled, in its most important places, by men of education and experience. Especially was this so of the engineering staff. Their men were trained in engineering, apart from gas engineering, before they came to the gas department; and they worked in a most conscientious manner. In fact, having to do with a few gas undertakings in this country, he often said he wished there was the same scrupulous care here over the small details, more particularly in the matter of residuals. The precision and care with which every small thing was turned to account was most remarkable, and to the different matters of extension from the engineering point of view, there was devoted not on'y competence, but great care and study.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 269.)

Business on the Stock Exchange last week was very quiet all through; and towards the end the attendance became so thin owing to the absentees being tempted away by delightful weather and out-door attractions, that there was scarcely any movement at all. The varying tendencies were not so pronounced as they had been in the week before; but still the tone was capricious and irregular. The opening afforded a fairly promising prospect. There was some buying, and one or two important markets improved. But the gilt-edged was not among the number. On Tuesday, things marched irregularly; Consols recovering fractionally, while Rails were poor. This line of action was exactly reversed the next day; while in other departments there were irregular ups and downs. On Thursday, the general prevailing tendency was dull; and the gilt-edged division was depressed by the influence of unwelcome new issues. Friday was a very quiet day, and things remained dull; the American Market being about the only one able to throw off depression. Saturday was almost a *dies non*; and markets remained steady and listless. In the Money Market, there was an abundant supply to meet all demands; and rates for short loans were very easy. Discount rates held on for a while, but gave way at last. Business in the Gas Market was, on the whole, quieter than the previous week; only two or three days furnishing a respectable quota. The general tendency was quite favourable; and movements in quotation, though few in number and slight in degree, were in the upward direction. In Gaslight and Coke issues, the ordinary was fairly active and very steady. The announcement by the Board of Directors that, after paying the same rate of dividend, they would carry forward a balance of undivided profits greater by £77,000 than they did six months ago, reached the market apparently too late to have any effect. The figures at which transactions were marked ranged from 96 to 97½. In the secured issues, the maximum was done at 89 and 90, the preference at from 105 to 107, and the debenture at from 82½ to 83½. South Metropolitan was quiet and firm; dealings being marked at from 120½ to 122 in the ordinary, and at 82¼ and 82⅜ in the debenture stock—a rise of 1 in each issue. The only transaction in Commercial was one in the 4 per cent., at 107. The Suburban and Provincial group were quieter than usual. Alliance new was done at 13⅜, British at 42, South Suburban at 118½, and Tottenham "B" at 101. Among the Continental Gas Companies, Imperial was 2 points higher, with transactions ranging from 172¼ to 174½. European fully-paid was ½ higher, at 23¼ and 23⅝; and Union was done at 113. Among the undertakings of the remoter world, Buenos Ayres changed hands at 11⅛, Primitiva at 6 15/16, ditto preference at 5 1/16 and 5 3/16, River Plate at from 12 15/16 to 13⅛, ditto debenture at 94½, San Paulo 13¼ (a rise of ¼), and Monte Video at 10⅜.

ELECTRIC LIGHTING MEMORANDA.

Puffing the Osram Lamp in the Daily Press—Ill-Considered Cost Comparisons—Some Considerations for the Public—Reputed Long Life with a Weakly Constitution—Some Calculations from the "Electrical Review," and a Supplement.

The General Electric Company, who own in this country the patents for the Osram metallic filament lamp—one of Baron Welsbach's inventions—have, we fancy, been setting their tooter to work in the Daily Press; for last week pretty articles on all the nice points of the Osram type of lamp appeared in the "Daily Telegraph" and the "Standard," and, by sundry contortions, the latter paper jumped—it did not arrive at it by any complete and serious consideration of the subject—at the conclusion that the Osram lamp was the one thing that the electrical industry has been waiting for to make electric lighting cheaper than gas. Of course, that is news to the electrical industry, the workers in which are able, by their technical knowledge, to look behind the scenes with clearer perception than the journalists of the Daily Press, whose capacity for receiving, believing, and misleading on technical matters is one of the wonders of modern times. There are several things touching upon the question of the first and running costs of the Osram lamps of which the daily journalist knows nothing, and so he accepts, as his informative base for misguiding the public, that the efficiency of the Osram lamp is four times that of the carbon filament lamp. The "Daily Telegraph" says that—

> With one Osram lamp of 32-candle power and one carbon lamp of 16-candle power, there is a very great saving per 1000 hours in favour of the new invention. With electricity at 4d. per unit, the saving figures out at 4s. 8d.; at 6d. per unit, the saving is 8s. 6d.; and at 8d. per unit, it is 12s. 4d.

What will be said later will show that this naked statement does not deserve any credence. After stating that the new invention is going to exert a "considerable influence on the lives of the people," the "Standard" makes these remarks—

> To compare it [the Osram lamp], in the first instance, with gas. With an incandescent gas-burner consuming 4 cubic feet, and having a bye-pass consuming ¼ cubic foot per hour, the cost for lighting per annum per 1000 burning hours, and with the bye-pass constantly alight, with gas at 3s. per 1000 cubic feet, would be 18s. An "Osram"

lamp, *giving the same illuminating value*, will consume 35 watts, and will cost for the same burning hours 11s. 8d. with electric light at 4d. per unit, or 14s. 7d. if the price is 5d. per unit. Thus electric lighting, with all those conditions which make it so great a luxury, is now made available at a lower price than gas lighting.

Surely now, after such an oracular statement, we ought to take a back-seat, and keep silent, on the principle that the least said the soonest mended. But no such intention animates us just at the present time; for the credulity that allowed the publication in the "Standard" of the quoted passages is so prominent a feature of the statement that we cannot refrain from having a tilt at our contemporary.

A few words first as to the consumption of the incandescent gas-burner. It is put at 4 cubic feet per hour; and thus the consumption, assuming the burner to be used 1000 hours a year, amounts to 4000 cubic feet. But we fail to see why the incandescent gas-burner should be saddled with ¼ cubic foot per hour consumption for the remaining 7760 hours in a year for a bye-pass jet, when a penny or two spent in safety matches will do all the lighting necessary for the one burner in the 1000 hours. The calculation for the cost of gas is thus reduced to 12s., at 3s. per 1000 cubic feet, instead of 18s. Then electricians have given their authority for stating that 18 candles (the whole British standard candle, and not the Hefner candle, which only equals 0·88 of 1 of the British type) can be obtained per cubic foot of gas consumed with respectable ordinary incandescent burners; so that the consumption of 4 cubic feet per hour should give, under easily maintainable proper conditions, 72 candles. Now how can the writer of the "Standard" article reconcile with facts his statement that the Osram lamp makes electric lighting available at a lower price than gas lighting. An Osram lamp, he says, giving "the same illuminating power" as the incandescent gas-burner, will consume 35 watts per hour; and we see in a table given later in his article that a 35-watt Osram lamp has a nominal illuminating power of only 32 candles, and those are Hefner candles from which 12 per cent. must be knocked off to find the equivalent in British standard candles. On the authority of Mr. Lancelot Wild, of the Westminster Electrical Laboratory, the illuminating power of Osram lamps is from 26 to 29 candles (British standard); and the consumption of watts from 34 to 36, and from about 1·2 to nearly 1·4 watts per candle. Again, it is not—if it is, he does not say so—within the knowledge of the writer in the "Standard" that, with the pressures for the greater part in vogue in this country, two of the Osram lamps will have to be used in series; so that, while the cost for current and lamps will in the majority of places have to be multiplied by two, the illuminating power of the two lamps—say, 60 candles together—will not come up to that of the one 4 cubic feet per hour incandescent gas-burner. Upon this, there is the first and renewal cost of the Osram lamps; and this is much heavier than in the case of incandescent gas mantles. A 32 Hefner nominal candle power Osram lamp costs 4s.; a 50-candle power one, 4s. 3d.; and a 100-candle power one, 6s. 6d.

Long life is claimed for these Osram lamps; but there are a few considerations affecting this point. The diameter of the filament is only 0·04 mm., which is finer than the average human hair. And there is electrical authority for saying that for voltages from 125 to 130, the lamps must be used in a vertical pendant position, as the filament at the high temperature to which it is heated when running is quite soft, and would otherwise sag against its supports. On the other hand, the filament when cold is brittle, and should not be jarred. It is therefore considered advisable when the holders in which the lamps are fixed are subject to vibration, to arrange for a flexible wire support. What affectionate care will have to be taken of these lamps to ensure good and constant service! When all these matters are taken into consideration, we are not so confident as the "Daily Telegraph" that "when the householder becomes aware of the advantages of the new light, there will be a great demand for this method of illumination," nor as the "Standard," that the "invention must exert a considerable influence on the lives of the people," nor that the lamp "makes it economically possible for electric light to be carried into all the poorer houses and dwellings throughout the country," nor is the lamp going to make an enormous difference in the capital outlay for generating-stations. Wild and uninformed writing such as our daily contemporaries have been indulging in will not help the electric industry. The public will not be long learning the disadvantages as well as the advantages of the lamp. We grant freely the one advantage compared with the carbon filament lamp, of greater efficiency in respect of illuminating power and wattage; but are there not in what we have written points which materially discount that one gain? It is not a gain that stands unaffected.

Our better-informed friends of the "Electrical Review" see things through glasses different from those of the writers in the two daily papers. The optimism of the latter finds no echo in these lines from the "Review:"

> The difficulty in obtaining supplies of lamps of the tungsten group, coupled with the fact that their present working pressure appears to be limited to 100 or 110 volts, has so far put obstacles in the way of their general application. Few consumers at the present stage feel justified in incurring the expense of altering their installation in order to effect a first economy in use, which is to some extent discounted by the high price and greater candle power of the lamps supplied, and is ultimately an uncertain quantity, owing to the little information available with regard to life and durability under ordinary conditions of use.

Our contemporary, however, does see cases—as in shops where artificial light is used to a late hour—presenting opportunity for the use of "current-saving lamps," even at considerably greater first cost. Apology must be made to the "Review" for quoting so extensively from its article; but the importance attaching to the calculation which is the kernel of the article is such that we prefer not to paraphrase the statement—

> With an alternating current supply, and the installations divided into equal groups of about 100 volts pressure by means of auto-transformers, an improvement of the following order may be anticipated: Taking ten 30-watt lamps of 32 nominal candle power, the maximum out-of-balance current will be about 1·5 amperes. An auto-coil to deal with this can be obtained for £3, having a consumption not exceeding 3½ watts. If this voltage reducing apparatus be erected and energized at the expense of the supply authority, the yearly cost will be—
>
> | | |
> |---|---|
> | £3 at (say) 10 per cent. for capital charges and depreciation | 6s. 0d. |
> | $\frac{3{\cdot}5 \text{ watts} \times 8760 \text{ hours}}{1000}$ = 30·66 units at (say) 1d. | 2 7 |
> | | 8s. 7d. |
>
> Say, 10s. per annum, which should be easily recoverable as a rental. The comparison in cost of the lighting between carbon and metal filaments per year of 1800 hours would be as follows:—

Metallic Filament.		Carbon Filament.	
Ten 32-c.p. 30-watt lamps = 320 c.p		*Ten 16-c.p. 60-watt lamps = 160 c.p.*	
$\frac{10 \times 30 \times 1800}{1000}$ = 540		$\frac{10 \times 60 \times 1800}{1000}$ = 1080	
540 units at 4d.	£9 0	1080 units at 4d.	£18 0
Extra rental of an auto-coil.	0 10	Say, three renewals of lamps (average life 600 hours), 30 at 1s.	1 10
Say, three renewals of lamps (average life 600 hours), 30 at 4s.	6 0		
	£15 10		£19 10

> Showing in favour of the metallic lamp an economy of over 20 per cent., with a nominal increase in light of 100 per cent.

We assume from the figures that the writer of the article has the Osram lamp in mind, as we know of no other metallic filament lamp claiming an efficiency approaching the one taken in the computation here—less than a watt per candle power! If we are right as to the Osram lamp being in view, then the calculator may be referred to the remarks on the candle power and to Mr. Wild's and the General Electric Company's figures as to the wattage for a 32 Hefner candle lamp. The candle power is about 4 candles too high by British measurement; and the watts 5 too low per lamp per hour. This will make a little difference in the totals of the first table. For the purpose of comparison, we will add another table to the two presented by our contemporary:

Ten 64-c.p. incandescent gas-lamps 3½ cubic feet per hour = 640 c.p.

10 × 3½ × 1800 = 63,000 cubic feet.

63,000 cubic feet at 3s. per 1000 c. f.	£9 9 0
40 mantles at 4½d.	0 15 0
	£10 4 0

Thus doing an injustice to all towns that supply gas at below 3s., and taking the high average of four mantles per burner per annum, it is found, on the basis of the "Electrical Review" calculations, that twice the illuminating power can be obtained with ten incandescent gas-burners at a price £5 6s. lower than the best our contemporary can show for metallic filaments.

Reported Discovery of Coal in Sussex.—The Central News learns that, as a result of investigations undertaken at the instance of Earl De La Warr, an important discovery of coal has just been made upon his Lordship's Sussex estate, in the neighbourhood of Ashdown Forest. The seam, which runs north and south, is stated to be at some points within 20 feet of the surface. Experts had been experimenting in the district for some time, and had formed the opinion that the area would be found to be coal-bearing.

Prevention of Corruption Act, 1906.—Readers may remember that at the annual general meeting of the Society of British Gas Industries early in the year a paper dealing with the above-named Act was read by Mr. C. E. Brackenbury, Barrister-at-Law, In preparing the paper, the author confined himself mainly to the points of more especial interest to his audience. He has, however, since recast and added to it, so as to render his exposition of the Act of general use. In its extended form it has been reprinted as a pamphlet, published by Messrs. Stevens and Sons, No. 120, Chancery Lane, price 1s. net.

The Late Sir William Perkin.—The funeral of Sir William Henry Perkin, F.R.S., whose death, on the 14th inst., was recorded in the "Journal" last Tuesday, took place the next afternoon at Christ Church, Roxeth, Harrow, amid signs of general mourning. Among those present were Professor W. Odling, F.R.S., representing the University of Oxford; Professor R. Meldola, F.R.S., representing the Royal Society and the Chemical Society; Professor Percy F. Frankland, F.R.S., and Dr. E. Divers, F.R.S., representing the Institute of Chemistry; Sir R. Pullar, M.P., Sir Boverton Redwood, with Mr. C. Creswell and Mr. S. Hall, representing the Society of Chemical Industry; Professor W. A. Tilden, F.R.S., and Sir W. Ramsay representing the Chemical Society; Dr. L. T. Thorne, Professor H. E. Armstrong, F.R.S., Professor Clowes, and Professor Emerson Reynolds, F.R.S.

THE INTERNATIONAL PHOTOMETRIC COMMITTEE.

Second Session at Zurich.

(From our Special Correspondent.)

It is rather more than four years since the International Photometric Committee, which was nominated originally by the International Gas Congress at Paris in 1900, held its first session in Zürich on the eve of the general meeting of 1903 of the German Association of Gas and Water Engineers in that attractive town. The second session, which, according to the arrangements made then, should have been held in 1905, has been deferred from time to time, and was ultimately fixed for the final three days of last week, when it was a real pleasure to see gathered together again in the industrial capital of Switzerland the majority of the members of the Committee who attended the session four years ago. There were notable and much regretted absentees. Death, alas! had removed one of the members—Herr H. Nachtsheim, of Vienna. Professor Vivian B. Lewes and Mr. Charles Carpenter, of London, Dr. H. Bunte, Professor at the Technical College at Carlsruhe, and Heer J. van Rossum du Chattel, of the Amsterdam gas undertaking, were all prevented by other claims on their time from attending the present conference. The absence of the last named was especially lamented, because it was known to be due indirectly to the recent death of Heer van der Horst.

Notwithstanding the enforced abstentions, there was a notable assembly of photometricians from all parts of the Continent when the session opened on Thursday at 10.30 a.m. at the Grand Hôtel Bellevue au Lac. The members present were: Signor M. Böhm, Engineer of the Milan Gas-Works, and delegate of the Italian Gas Engineers' Society; Professor E. Brodhun, of the Imperial Physical Technical Institute, Charlottenburg; Dr. H. Drehschmidt, Chemist to the Berlin municipal gas undertaking; Mr. J. W. Helps, Chief Engineer of the Croydon Gas Company, and delegate of the Institution of Gas Engineers; Dr. H. Krüss, of Hamburg; M. Laporte, Assistant-Manager of the Central Electricity Laboratory at Paris; M. Lauriol, Chief Engineer of Public Lighting at Paris; Herr J. Nolte, General Manager of the New Gas Company of Berlin, and President of the German Association of Gas and Water Engineers; M. Sainte-Claire Deville, Chief Engineer of the Experimental Works of the Paris Gas Company; Dr. H. Strache, Professor at the Technical College at Vienna, and delegate of the Austro-Hungarian Association of Gas Engineers; Dr. L. J. Terneden, Chemist of the Amsterdam Gas-Works, and delegate of the Dutch Association of Gas Managers; Herr A. Weiss, Manager of the Zürich gas undertaking, and delegate of the Swiss Gas Engineers Association; and M. Th. Vautier, Professor at the University at Lyons, who presided, as in 1903, at the conferences held. Mr. C. C. Paterson attended as a delegate from the National Physical Laboratory at Teddington; and the indefatigable and genial Editor of the "Journal des Usines à Gaz," M. Ph. Delahaye, again acted as Secretary to the Committee. It will be seen, therefore, that, as no fewer than seven countries were represented at the session of the Committee, the proceedings may be rightly regarded as being truly international in character.

Welcome to Zurich.

The Municipality of Zürich extended a warm welcome to the delegates, and on Friday evening entertained them lavishly at a banquet at the Grand Hôtel Bellevue, at which Herr Fritschi, one of the City Councillors, presided on behalf of the Burgomaster. The town of Zürich was throughout in gala dress, owing to the concluding matches of the Federal Rifle Meeting being in progress when the session of the Photometric Committee opened.

Opening of the Business.

The proceedings formally commenced on Thursday morning at 10.30, when the delegates assembled in a room at the Grand Hôtel Bellevue. M. Vautier, on taking the presidential chair, expressed the regret of the members at the absence of Dr. Bunte, Professor Vivian B. Lewes, Mr. Charles Carpenter, and Heer van Rossum du Chattel. On his proposal, Herr Nolte and Mr. Helps were elected Vice-Presidents of the Committee. He then referred to the changes which had taken place since the last meeting in the constitution of the Committee—viz., the substitution of Professor H. Strache for Herr Nachtsheim (deceased) as representative of Austria-Hungary, and of Herr Nolte for Herr W. von Oechelhaeuser as one of the representatives of Germany. Next he announced that the authorities of the Federal Polytechnic at Zürich had, at the instance of Professor Lunge, who, unfortunately, was prevented by illness from welcoming them, placed at the disposal of the Committee for their subsequent meetings one of the lecture theatres in the Chemical Laboratories. Also, Professors Coustam, Grandmougin, Treadwell, A. Weber, and Weiss, of the Polytechnic staff, had kindly promised to act, together with a number of their assistants, as interpreters at the meetings.

Photometry of Lights of Different Colours.

The first communication taken was a paper by M. Lauriol, of Paris, on the "Photometry of Lights of Different Colours." A translation of this paper is given on another page [243] of to-day's "Journal." The proposals of the author were discussed by Herr Brodhun, Herr Krüss, M. Laporte, M. Sainte-Claire Deville, Mr. Paterson, and Herr Strache. The general trend of the remarks was to the effect that the suggested wedge type of photometer depended for its accuracy on the exact setting of the wedge, which was a matter of great difficulty. Mr. Paterson found no difficulty in comparing electric filament lamps, giving lights of different tints, with one another; and the ratios which he found to subsist between them had been confirmed by Professor Brodhun at the Reichsanstalt. This was the case, notwithstanding that the distance of the sources from the screen varied in the two places; the illumination at the National Physical Laboratory being one candle-metre, and at the Reichsanstalt ¼ candle-metre. M. Lauriol having observed that his experiments covered a range of sources of light of very widely differing colours, the President summed up the points raised in the paper, and recommended the members of the Committee to institute further experiments in the directions suggested by M. Lauriol, as they would doubtless be of great service in photometry in general. The morning's session then closed.

Reports of the German, French, and English Laboratories.

On Thursday afternoon, the Committee re-assembled at the Chemical Laboratory of the Polytechnic, and received the reports of the German, French, and English Laboratories on their investigations on the ratios subsisting between the Carcel, Hefner, and Harcourt standards of light. Professor Brodhun first read the more essential parts of a paper by Dr. E. Liebenthal, of the Reichsanstalt, on the comparisons made at that laboratory of the three standards. This paper was a reproduction of the one by the same author as presented at the meeting of the German Association of Gas and Water Engineers at Bremen last year, and of which a translation has already been given in the pages of the "Journal."*

In reply to a question by the President on the point raised by Dr. Liebenthal, as to the variation of the light of the Harcourt 10-candle standard with variations in the setting of the height of the flame, Mr. Paterson said that, in his experience, the light was constant when the height of the flame was not more than 1 mm. above or below the normal position; but that when the height of the flame was 2 mm. above or below the normal, a variation of 0·2 to 0·3 per cent. in the light was introduced.

Mr. Paterson then presented the report of the National Physical Laboratory on the comparisons made there at the instance of the Institution of Gas Engineers. This report was substantially a translation (in French) of that made by the Laboratory to the Institution in May, 1905, which has been regarded by the Institution as confidential pending this meeting of the members of the International Committee. Though a considerable part of the results of the work covered by the report has been divulged by Mr. Paterson in the paper which he read in January last before the Institution of Electrical Engineers, we take the opportunity of reproducing, on another page of to-day's "Journal" [232], the actual report made by the Laboratory to the Institution of Gas Engineers. Mr. Paterson stated that, since the report was prepared, his further experience with more Harcourt lamps had indicated that new lamps had a somewhat lower candle-power. The lamps seemed to increase somewhat in illuminating power by use up to a certain point. The increase amounted to from 0·5 to 0·75 per cent. He had not been able wholly to account for this change; but it seemed partly associated with the inner chimney of the lamp. On changing a new chimney for an old one, there was an appreciable increase in the light afforded. He mentioned the fact because the lamps used at the German and French laboratories were probably not so old as the one used at the English laboratory, and therefore might have a slightly lower illuminating value. He was sure there was such a difference as he had mentioned, though he was not so sure of the cause. Mr. J. W. Helps said that he understood that no such differences had been observed in the laboratory of the Gas Referees in the many lamps examined there.

The report on the investigations made at the French Laboratories by M. Perot and M. Janet was then presented and discussed. This report has also been previously dealt with in the "Journal." A supplementary report on further investigations was also presented by M. Laporte, who afterwards read a summary which he had prepared of the results obtained in the comparison of the three standards at or by (1) the Reichsanstalt, (2) the National Physical Laboratory, (3) the Laboratoire d'Essais du Conservatoire National des Arts et Métiers and the Laboratoire Central d'Electricité de Paris, (4) Mr. Sharpe, in 1903, (5) Mr. Hyde, in 1906, and (6) MM. Laporte and Jonaust, in 1907. After considerable discussion, a Sub-Committee, consisting of Professor Brodhun, M. Laporte, and Mr. Paterson, was appointed to prepare a recommendation as to the ratios which

* See "Journal," Vol. XCV., p. 102.

the Committee should assign as subsisting between the values of the three standards, and submit it for adoption at a subsequent session of the Committee. This closed the day's proceedings.

Photometry of Incandescent Burners.

The Committee met again on Friday morning at the Polytechnic; and the first matter was the reading by the President of a communication which Heer van Rossum du Chattel had forwarded, dealing with the methods adopted in Holland for measuring the light of incandescent gas-burners. An abstract translation of this communication is given on another page to-day [235]. The communication led to a discursive discussion on the photometry of incandescent burners, especially in relation to spherical and hemispherical illuminating power and the methods for determining either. Further particulars of this discussion will be given in the continuation of this report next week.

Mr. Helps then made a report on the methods of measuring the light of incandescent burners in use in England. He said that he had applied to about 250 engineers of gas-works for information on the point; but the replies received indicated that there was very little systematic testing of incandescent burners carried on in English gas-works. As to the form of photometer, the ordinary enclosed Letheby seemed most general; but, specially for mantle testing, the Flicker photometer, adapted for measuring either horizontal or angular illuminating power, was also used. Only very few engineers were using the photometer devised by himself and Mr. Carpenter which was exhibited at the last meeting of the International Committee. He believed this was not due to any defect of that photometer, but to the fact that no attempt had been made to push its sale. Horizontal readings only were commonly made in English gas-works; and for upturned incandescent burners, they appeared to suffice. But angular readings were very important in the case of inverted burners, as figures which one gas engineer had communicated to him indicated. They referred to five types of inverted burner. Generally speaking, there was a falling off from the horizontal illuminating power at an angle of 10° to 12° below the horizontal, and then a continuous rise up to 90° (or vertically downwards). For the five burners, the values for the horizontal and the vertically downwards measurements were as follows:—

Duty Obtained, Candles per Cubic Foot.	Burner No. I.	Burner No. II.	Burner No. III.	Burner No. IV.	Burner No. V.
Horizontal	16·75	13	13·9	12·3	14·9
Vertically below	28·7	25	25·7	25·2	31·8

These figures, he thought, proved the necessity for angular readings. A question which was now being seriously discussed by English gas engineers was whether the time had not arrived for a standardization of sizes of incandescent burners and mantles, in order to effect economy in maintenance by only a few sizes of mantles being requisite. There should be no great difficulty in standardizing the sizes of upturned burners; but the inverted burner had not yet advanced to such a stage that standardization could be arranged. Mr. Helps took the opportunity of apologizing on behalf of Mr. Carpenter for his enforced absence from the meeting.

After some further discussion on the question of spherical or hemispherical determinations for expressing the value of sources of light, the meeting was adjourned to the afternoon.

When the Committee re-assembled, there was some discussion on the practicability of a molten platinum unit as a primary reference standard of light. Then the subject of discussion was that of a standard incandescent burner for mantle testing, and the shape of mantles.

Illuminating Power in Self-Luminous and Incandescent Burners.

On Saturday morning, M. Sainte-Claire Deville presented a voluminous communication on researches which he had conducted on the illuminating power in self-luminous and incandescent burners of coal gas, water gas, and mixtures of the two gases. This was in continuation of the work which he described at the last meeting of the International Committee, of which a detailed report was given in the "Journal" at the time (Vol. LXXXIII., pp. 499, 567, 617). The subject was discussed, mainly by Dr. H. Strache and M. Vautier.

Ratios of Standards of Light.

Then the report of the Sub-Committee on the ratios subsisting between the intensities of the three standards of light was presented and adopted by the meeting. It was decided that the relative values should be taken as follows:—

Carcel . . = $10{\cdot}7_5$ Hefners
Harcourt . = $10{\cdot}9_5$,,
,, . = $1{\cdot}02_0$,,
} Probable error ± 1 per cent.

The small figures written beneath the line could not be regarded as significant. The ratios were stated in this manner, because the figure was thus always greater than unity. The standards were taken to be burning under the normal conditions of atmospheric humidity for each—viz., for the Carcel and the Harcourt standards, 10 litres of aqueous vapour to 1000 litres of dry air; and for the Hefner standard, 8·8 litres to 1000.

The views of some of the individual members of the Sub-Committee were given by way of putting on record that they were not in entire agreement as to the form of the statement adopted.

New Testing Burner for London Gas.

On Saturday afternoon, Mr. Helps read a paper on the "New Standard Burner for Testing the Illuminating Power of London Gas," written by himself and Mr. Carpenter; and he showed the "Metropolitan" argand burner No. 2 in use, and explained its operation. The paper is reproduced on another page [235] of this issue. Discussion ensued on this and M. Sainte-Claire Deville's paper, already referred to; and Mr. Helps stated that no consideration would now induce English gas engineers to go back to the plan of burning the gas at such a rate as would afford a flame of fixed intensity, nor to give up the new standard burner.

The Committee's Resolutions.

The Committee then proceeded to settle certain resolutions based on the matters discussed at the meeting; and ultimately the following were moved and passed unanimously:—

I.—The International Committee on Photometry, having taken into consideration the adaptability of the electric furnace to the fusion and distillation of the refractory metals, as demonstrated by Moissan, express the wish that researches should be pursued in the interest of photometry on the fusing point of platinum. The Committee instruct their Secretary to communicate with the National Laboratories of the countries concerned with the object of elucidating this problem.

II.—The Committee thank M. Sainte-Claire Deville for his important communication in continuation of his former work, and express their desire that experimental researches on the maximum illuminating power of the gas to the calorific power should be continued in the different countries.

III.—The Committee decide, on the suggestion of Professor Drehschmidt, to adopt the following symbols for illuminating power determined in the manner indicated:—

I_h = Horizontal illuminating power.
I_{α_s} = Illuminating power at an angle α to the horizontal above the horizontal.
I_{α_i} = Illuminating power at an angle α to the horizontal below the horizontal.
I_o = Mean spherical illuminating power.
$I_{\overline{U}}$ = ,, upper hemispherical illuminating power.
$I_{\underline{U}}$ = ,, lower ,, ,, ,, ,,
$I_{m\,\alpha\,s}$ / $I_{m\,\alpha\,i}$ = Maximum illuminating power in the upper (s) or lower (i) hemisphere, that maximum occurring at the angle α.

IV.—The International Commission on Photometry particularly direct the attention of the Photometric Committees of the various countries to the utility of determining the illuminating power of ordinary self-luminous flame burners and incandescent burners, both upturned and inverted, and to the establishment for the latter of the most satisfactory method of determining the mean hemispherical and spherical intensity, and ask those Committees to communicate the results to them.

Next Meeting.

The President read a letter from Dr. Love, of New York (who is a member of the Committee), expressing his sincere regret that he had been unable to take part in the proceedings, owing to the fact that he was busy establishing new testing-places in that city, and expressing his best wishes for a successful issue from the labours of the Committee.

It was decided, on the motion of Herr Weiss, that the Committee should hold their next meeting in about three years' time at Zurich, about the date July 20. Herr Weiss proposed a vote of thanks to M. Vautier for his services in the presidential chair; and it was passed with acclamation.

The late Mr. R. W. B. Creeke, the Managing-Director of Messrs. Henry Balfour and Co., Limited, of Leven, Fife, whose death was recorded in the "Journal" for April 9, left £3641.

Mr. John Devonshire Ellis, late Chairman and formerly Joint Managing Director of Messrs. John Brown and Co., Limited, of Sheffield, whose death last November was at the time recorded in the "Journal," left estate of the gross value of £56,725.

At the meeting of the Metropolitan Water Board on Friday, the Water Examination Committee reported that an application had been received by them from the Egyptian Government stating that it had been decided to appoint an International Conference of English, French, and German delegates to meet in Cairo to consider the water supply of Egypt. They had approached the Royal Society to nominate an English delegate; and the Society had recommended that Dr. Houston, the Board's Director of Water Examinations, should be appointed. The conference would last fifteen days, and Dr. Houston would be paid £750 for his services. The Committee recommended that he be permitted to go. A long discussion followed, on the advisability of allowing officers of the Board to accept such invitations. It was pointed out that Dr. Houston had recently been to Belfast, and received a fee of £370 for his visit; and now it was proposed to let him go to Egypt at a time of the year when his services were most required in the Metropolis. Eventually, however, the recommendation was agreed to.

THE LIGHTING OF SMALL TOWNS.*

Gas v. Electricity Works.

THE small *brochure* which Herr Würdemann has prepared on the comparative results, financially, of the supply of light in quite small towns from either a gas-works or an electricity works, is full of statistics of a most instructive kind. His avowed object is to assist municipal or parochial authorities in making a proper choice of lighting plant for the public and private service. He points out that while there may nominally be many kinds of illuminating gas—for instance, water gas, air gas, and acetylene—practically the authorities need only consider coal gas, because the other gases named are less suitable for heating, cooking, and the development of power as well as for lighting. Hence the question is narrowed down to one of coal-gas-works or electricity works. Neither of them is purely a light-supply station, because with both a large part of the output will be for other than lighting purposes.

Having restricted the issue to coal gas or electricity, Herr Würdemann goes on to say that it is the duty of the local authority to erect the lighting works which will be of service to the largest number of the ratepayers. If gas-works and electricity works should be equally serviceable, then the one to be chosen must be that which should afford the best financial result, and so lay the smallest expenditure on both individual ratepayers and the community. In deciding this question, it is clearly necessary to know what has already been accomplished elsewhere by the two classes of works.

The *brochure* before us gives this information in a convenient form for a number of small towns in Germany. The plan followed has been to take two towns of nearly the same size and in the same neighbourhood, one of which has a gas-works and the other an electricity works. Then, side by side are placed the statistics (derived from the burgomaster or the works' manager) for the two cases—viz., the numbers of inhabitants, of households, of street-lamps, of consumers for lighting purposes, and of consumers for other purposes, the amount of current or gas sold and the prices, the capital expenditure, and (last but not least) the profit or loss. The average light obtained in each case is also reckoned out, on the basis of 350 Hefners (say, 320 candles) per B. of T. unit, or 80 Hefners (say, 73 candles) per 100 litres (= 3·53 cubic feet). This duty for gas is equivalent to 20½ candles per cubic foot. Other useful data are also included in the comparative tabular statements, which refer to sixteen pairs of towns—one of the pair having gas-works and the other electricity works.

We take the liberty of quoting some of the figures for one pair of towns in Hanover—Bentheim—which, with 4300 inhabitants, runs an electricity works, and Ahaus, which has 4500 inhabitants and owns a gas-works. There are 865 and 900 households in the respective towns, and for public lighting 119 glow lamps in the one and 110 gas-lamps in the other. But the glow lamps, alight for 2000 hours per annum, cost 7000 marks, and afford a total light of 6 million Hefners; while the gas-lamps burn 1600 hours at a cost of 2250 marks, and afford 13½ million Hefners. In all, 18·8 per cent. of the households take electricity for lighting purposes in Bentheim, and 25 per cent. take gas for the same purposes in Ahaus, while 8 per cent. also take it for cooking, for which electricity naturally fails to attract a single consumer. But Bentheim has 10 electro-motors of 32-horse power, and Ahaus only 3 gas-engines of 5-horse power. Current is charged at 7·2d. per B. of T. unit for lighting, and at 2·4d. for power (at Bentheim); gas at a little over 4s. 6d. per 1000 cubic feet for lighting, and a little under 3s. 5d. for power (at Ahaus). At these rates, 20,000 marks are paid for current for lighting, and 12 million Hefners obtained; 15,100 marks are paid for gas, and 76½ million Hefners are obtained; while the price paid per horse-power per hour by power customers is 2·16d. for current, and 0·84d. for gas. The capital expenditure on the Bentheim electricity works was 286,400 marks, and the working shows a loss of about 22,000 marks (= about £1100); while the gas-works at Ahaus have cost 175,000 marks, and have returned a profit of about 4500 marks (= about £225).

We have not picked out a pair of towns in which the comparison is exceptionally in favour of gas. These are some of Herr Würdemann's general conclusions: For lighting purposes, only about 17·7 per cent. of households take electricity; while 44 per cent. take gas. The electricity consumers pay 152 marks on the average apiece, and the gas consumers only 59 marks; while the latter obtain the more light. In the sixteen electricity-supplied places, the power supply amounts to 312,350 horse-power hours; in the gas-supplied towns to 437,500 horse-power hours; while, further, gas goes to 25·2 per cent. of the households for cooking or heating purposes. For public lighting, electricity is universally dearer and gives less illumination. Notwithstanding that the gas-works meet a greater demand, the capital outlay (on the basis of any unit whatever) comes out lower. As regards profit or loss, the showing is indeed remarkable. The electricity works are not generally able to cover interest and depreciation charges, and in many cases are a considerable drain on the town chest; while gas-works in every case meet their interest and depreciation charges, and often show quite considerable profits.

These facts speak for themselves. We recommend the advisers of smaller municipalities, and consulting and constructing electrical and gas engineers generally, to study Herr Würdemann's careful compilation, which we understand was undertaken by him at the instance of the engineering firm of Carl Francke, of Bremen.

* "Die Beleuchtung Kleiner Städte, auf Grund Statistischer Unterlagen." Bearbeitet von Ingenieur W. Würdemann. Bremen: B. H. Reiners; 1907.

NOTES FROM WESTMINSTER.

THE process of clearing up is now going forward at Westminster; and it is safe to say there are few who will feel sorry when the present session has run its course. It has been most unsatisfactory in regard to public measures; and in connection with Private Bills, there has been very little animation. There are only a couple of notes to be presented this week; and both are on water topics.

A Long-Contested Water Scheme Won. The Great Yarmouth Water Company and the Lowestoft Water and Gas Company have won their joint Bill, incorporating a scheme for taking water from the River Bure; and the Great Yarmouth Corporation, who opposed, cannot complain that they did not have a fair and impartial hearing in both Houses. There has not been a scheme this session that has been gone into more thoroughly; and both the Lords and Commons Committees showed every consideration to promotors and opponents alike. But both pronounced in favour of the scheme, though both, too, increased the stringency of the conditions under which the powers to the Companies are granted. A feature of the case was that the Companies, in their own interests and in those of the public (which interests are identical), showed a perfect willingness to shoulder, before being compelled by the Committees, all obligations and duties essential to the protection from pollution of the proposed source of supply. The Companies want additional water; and the Great Yarmouth Corporation did not assail the necessity. It was only the source that they questioned. The Companies brought up engineering and chemical evidence to show the Committees that there was nothing threatening the purity of the Bure that could not be brought under subjection, given parliamentary power, by the means at command. The Companies secure their new source of supply at a heavy price; but it is the best and most available source offering for realizing an adequate supply. The Commons Committee have ordered that the subsidence reservoir to be constructed shall be of not less than nine days' capacity instead of seven; but a more serious condition—serious, but still accepted—is that such effective means are to be taken as are necessary to prevent any sewage or other offensive or injurious matter, solid or fluid, from passing into the river, between and including Coltishall and the point of the intake, down or through any sewer, drain, pipe, or channel. While this imposes a heavy responsibility on the Companies, it is locally feared that such plenary powers in the hands of the Companies for dealing with contamination will gravely affect the yachting industry and the wherry business on the Bure. The Companies may, however, be relied upon to exercise their powers with discrimination, in the interests of the public, from all points of view. The Bure itself as a pleasure resort will be none the worse for being maintained in a good sanitary condition.

Renfrewshire Upper District Water A note has already appeared on the Bill of the Renfrew County Council which proposes to constitute a new and large water-supply area, embracing the district served by the Busby Water Company. Reservoirs are projected at Bennan Loch and Loch Craig, at an estimated cost of £46,000. The Busby Water Company's undertaking is to be taken over by the County Council. Sittings over seven days were devoted to the consideration of the measure by Major Seeley's Committee—the Glasgow Corporation being in opposition. The Corporation had suffered a fall before the Earl of Camperdown's Committee with a scheme of their own; and they did not want the Renfrew County Council to get these water powers, as it was conjectured that it would spoil a project of annexation that the Corporation have in hand. Glasgow, when before the Committee, did everything possible to prevent what they appeared to think would be a catastrophe for their scheme. But Glasgow only began to attach importance to the water scheme when annexation was mooted. Among the points vigorously discussed was as to whether Glasgow could supply the higher ground in the district; but it was shown that the Corporation were willing to buy the Busby water-works. They offered to supply at a tenpenny rate; and evidence was forthcoming that the Corporation could not better the County Council in this respect, and the ultimate benefits of Glasgow's project were viewed with doubt. In the end, the County Council went off with their scheme; and the representatives of Glasgow to get cured of their chagrin as quickly as possible. Their disappointment was noticeably keen.

The Centenary of Gas Lighting.—In consequence of the pressure on our columns to-day, owing to the report of the proceedings at the Photometrical Congress, and other matters requiring immediate notice, we are compelled to hold over the next instalment of the article on "The Centenary of Gas Lighting."

PERSONAL.

Mr. Wm. M'Giffin, Manager of the Huntly (N.B.) Gas Company, has been appointed Manager of the Wick Gas Company.

Last Saturday week was degree day at Liverpool University; and among the honorary degrees conferred was that of LL.D. upon Pro-Chancellor Sir Edward Lawrence, who for twenty-three years was Chairman of the Liverpool United Gas Company—a position he relinquished about three years ago.

The "Co-Partnership Journal" of the South Metropolitan Gas Company records the following resolution, which was unanimously agreed to at a special meeting of the Co-Partnership Committee last month: "That the Committee desire to express their deepest sympathy with Mr. Frank Bush in his long illness, and to express their hope that he may be soon restored to vigorous health and strength."

The position of Gas Manager to the Leek Urban District Council, which was rendered vacant by the removal of Mr. A. A. T. Botteley to Wolstanton, has been filled by the appointment of Mr. Sidney T. Smith, who is at present engaged at the Walsall Gas-Works. The salary is £180 per annum, with house, coal and gas, &c. Mr. Smith is one of the Vice-Presidents of the Midland Junior Gas Engineering Association.

Mr. George E. Ashurst, the Chief Clerk of the Wallasey Gas and Water Department, was successful at the recent associate's examination in connection with the Chartered Institute of Secretaries, held under the auspices of the Victoria University, Manchester. Mr. Ashurst at present holds a first-class certificate in "Gas Manufacture," and is also the possessor of a number of certificates for advanced book-keeping and accountancy, &c.

In the course of his speech at the meeting of the European Gas Company, Limited, last Tuesday, the Chairman (Mr. R. Hesketh Jones) referred to various changes which have had to be made in the Company's technical staff, consequent on the retirement of M. Marchal, the esteemed Manager at Nantes. We learn that M. Gustave Gautier has been removed from Rouen to take on the more responsible duties at Nantes. M. Huon (whom several of the members of the Institution of Gas Engineers had the pleasure of meeting last year) goes from Boulogne to Rouen. M. Cros proceeds from Amiens to Boulogne; and M. Bertin, Assistant at Rouen, has been elevated to the managerial post at Amiens. Satisfaction was expressed that the Company's own staff included officers technically qualified to assume higher responsibilities than those that had previously fallen upon them.

The resignation of Mr. William Angus (who, as already recorded in the "Journal," has gone out to Buenos Ayres) of the position of Works Superintendent at the Windsor Street Station of the Birmingham Corporation Gas Department, has brought about the following changes in the staff: Mr. E. B. Tomlinson, from the Adderley Street Works, has been appointed Assistant Works Engineer and Superintendent at Windsor Street, Mr. J. H. Darrah, Junior Engineer at Windsor Street, being transferred to Adderley Street as Acting Superintendent for the present. Mr. C. H. Edmonds, from the Laboratory Staff at the Saltley Works, has been given the post of Junior Engineer at Windsor Street.

Presentations of illuminated addresses and framed photographs of the employees at the Dewsbury Gas-Works were recently made to Mr. Charles A. Craven, who, on account of ill-health, some time ago resigned his position as Manager, and to Mr. George Bradley, who has retired after 32 years' service—for most of the period as yard foreman. Mr. G. W. Fligg, the new Manager, who presided, remarked that they all felt very much parting with two officials who had been with them for such a number of years. That they were thoroughly appreciated and very highly esteemed, was shown by the way in which everyone in all departments of the undertaking had subscribed. Mr. Bradley was with them that day in very good health; and they hoped he would live many years to enjoy his well-earned retirement. As to Mr. Craven, they were acquainted with his circumstances; and he (Mr. Fligg) would take the presents to Mr. Craven on their behalf. Mr. Bradley, in acknowledgment, said he hoped the men would continue to be as faithful to his successor and to Mr. Fligg as they had been to him personally and to Mr. Craven. If they stuck together as they had done in the past, he did not think there was another gas-works in England which could be more successful.

A very appropriate souvenir in the shape of large mounted photographs of the party has been prepared, by the kindness of Messrs. George K. Harrison, Limited, for those members of the Midland Junior Gas Engineering Association who were fortunate enough to be present last month at the visit to the firm's works and mines. Particular interest will attach to one of these photographs, from the fact that it was taken in the fire-clay mine by means of a flashlight; but both the underground and above-ground pictures will form a very welcome memento of what was, in the opinion of all who took part in it, a most enjoyable and instructive outing.

COMPARATIVE COST OF GAS AND ELECTRICITY.

[Communicated.]

It may perhaps be considered by "Journal" readers rather late now, with the temperature at summer heat, to direct their attention to a pocket-book and diary for the present year; but the one published by Messrs. Rentell and Co., of Maiden Lane, W.C., under the title of "The Practical Electrician's Pocket-Book and Diary for 1907," which is edited by Mr. H. T. Crewe, M.I.Mech.E., contains some comparisons of the cost of gas and electricity which show so much bias in favour of the latter as to make them ludicrous in the eyes of any experienced person. This observation may seem rather strong; but I think it will be borne out by what follows. In the series of tables giving the costs referred to, No. 1 shows the equivalent price of gas per 1000 cubic feet comparing an incandescent electric lamp and an ordinary (flat-flame) gas-burner; No. 2 shows the comparison with an incandescent gas-burner; and No. 3 gives the equivalent price comparing a Tantalum electric lamp with (1) an ordinary and (2) an incandescent gas-burner. The tables purport to show the equivalent price of gas compared with electricity at various prices, ranging from 1d. to 6d. per unit; but the equivalent price of gas compared with electricity at 3d. per unit has alone been reproduced below—this being the lowest charged as a flat-rate by any corporation or company in the London district.

	3 Watts per C.P.	3½ Watts per C.P.	4 Watts per C.P.
Table No. 1	2s. 5d.	2s. 7d.	2s. 9d.
Table No. 2	2 9	3 3	3 9

	(1) 1 Watt per C.P.	(1) 2 Watts per C.P.	(2) 1 Watt per C.P.	(2) 2 Watts per C.P.
Table No. 3.	1s. 0d.	1s. 6d.	1s. 4½d.	2s. 4½d.

Below the tables appears the following: "All the above tables take into account all renewals, gas and electric, and price of same as obtained in practice by the author."

It is difficult to understand how the figures are arrived at. No fault can be found with Table No. 1; but, as anybody with any pretensions to being economical and up-to-date would consider the use of "ordinary" (as they are called in this publication) or flat-flame (as they are properly named) burners an unwarrantable piece of extravagance, this table may be passed over as unworthy of notice.

In Table No. 2, it will be seen that, taking the efficiency of an incandescent electric lamp at 3½ watts per candle power, electricity at 3d. per unit is stated to be equivalent to gas, when consumed in an incandescent burner, at 3s. 3d. per 1000 cubic feet. Let us consider what justification there is for this comparison. Assuming that an incandescent burner consuming 4 cubic feet per hour gives a light of 60-candle power, or 15 candle-hours per cubic foot, the following will be a truer comparison:—

286 candle-hours costs 3d. with electricity at 3d. per unit, calculating on an efficiency of 3½ watts per candle-hour.

286 ,, ,, 0·74d. with gas at 3s. 3d. per 1000 cubic feet, calculating on an efficiency of 15 candles per cubic foot.

In other words—

1d. with electricity will give 96 candle-hours.
1d. ,, gas ,, ,, 384 ,,

Showing that gas at the high price of 3s. 3d. per 1000 cubic feet (2s. 6d. is the average price in London) is four times cheaper than electricity at the low price of 3d. per unit (3d. is the lowest flat-rate price in London).

The supporter of the "Electrician's Pocket-Book" will exclaim that when the question of renewals is taken into consideration the result is very different. According to Mr. Lancelot Wild, a 16-candle power electric lamp should be renewed after a lifetime of 500 hours. This means an expense of 10d. every 500 hours' Taking 250 hours as the minimum lifetime of an incandescent mantle, it will be seen that two mantles, costing (say) 3½d. each, or 7d. in all, will outlast an electric lamp. This allows 3d. per 500 hours to pay for chimneys, forks, and depreciation of burners. Some may say that 3½d. is not sufficient to buy a good mantle, and that 250 hours' consumption is too long to take as an average lifetime; but the writer's experience is with mantles retailed at 3½d. each, which are found to last, on an average, rather more than six months—a lifetime which would, on a moderate computation, allow a margin considerably in excess of 250 hours' consumption. It will thus be seen that, so far as renewals are concerned, no great difference is discernible in the relative use of gas and electricity. The writer has a lurking suspicion that these erroneous comparisons are based on the supposition that an incandescent gas-burner gives a light of only 16-candle power; otherwise the results are incomprehensible.

In another part of the publication under notice the author makes the following statement: "Improved burners and incandescent mantles have been devised to lessen the difference and improve the position on the part of gas; but the increased cost of such burners and the constant renewals of mantles necessary on account of their extreme fragility render it extremely doubtful whether the comparative actual cost in the long run is very much altered. This, of course, is quite absurd, and would pass unchallenged by none save the uninitiated.

Another paragraph reads: "When we come to the comparison of electric light (as produced by arc lamps) and gas, the advantage is altogether on the side of electricity; and in brilliancy of effect, power of illumination, and convenience in lighting large areas, gas can hardly be reckoned as a rival." Gas engineers should consider themselves fortunate that the Street Lighting Committee of the City of London do not share the opinion expressed above. In spite of such testimony to the brilliancy of electric light as produced by arc lamps, it may be worth recording that all the London bridges, as well as the new Victoria Station and the new thoroughfares Kingsway and Aldwych, are brilliantly and cheaply lighted by gas. Many like instances could be quoted as a refutation of the foregoing extravagant statement. A few more facts and a few less opinions would possibly increase the value of this aspiring little pocket-book.

INDUSTRIAL CHEMICAL ANALYSIS.*

THE book before us is the first part of a French edition of the comprehensive treatise by Professors Post and Neumann on "Analytical Chemistry in its Application to Industry." The complete work will comprise two volumes, each containing four parts. Judging from the specimen in our hands, each part may for practical purposes be regarded as a distinct book, so that the work will ultimately consist of eight octavo volumes.

A number of authors have collaborated in the production of the German work; and the translator has made some useful additions. There are four chapters in this part. The first, on water and residual waters, is by Dr. J. H. Vogel, of Berlin. As to the treatment of water analysis, the only criticism we need make is that too much space appears to be devoted to the determination of hardness by means of soap solution, and the modern, more exact, and simpler method of Hehner is relegated to quite a subsidiary position. Residual waters from industrial processes are broadly ranged in two classes—viz., those containing mainly organic and those containing chiefly inorganic matter. The inorganic matter is classified according to whether it is principally either salts of the alkalies or alkaline earths, or salts of the heavy metals or free acids; and, naturally, the analytical procedure is dictated to a large extent by the nature of the manufacturing operations from which the residual water comes. Precise rules to cover all cases are out of the question; but Dr. Vogel gives useful indications of the courses which will be found applicable in most instances.

The second chapter is on fuel, and is by Dr. Langbein, of Niederlössnitz, near Dresden. The usual methods for the ultimate analysis of coal, coke, &c., are given, and physical tests are described. The greater part of the chapter, however, treats of the determination of calorific power; and the translator has here introduced some useful original matter dealing with calorimeters of French origin. The third chapter, on "Pyrometry," is by Dr. Neumann himself. It affords an exceptionally complete account of the various systems of pyrometry, and describes the more modern types of pyrometers, whether water, thermo-electrical, or optical. In this chapter also the translator has made some useful additions.

The fourth and final chapter of this part of the work deals with the analysis of gas—including chimney gas, heating gas, gas for power purposes, and fire-damp. It is, like chapter three, by Dr. Neumann. The first portion is devoted to a general account of calorimetric methods and apparatus, the sampling of gases, &c. Next comes a description of various forms of gas analysis apparatus—viz., Hempel's, Bunte's, Villots', Drehschmidt's, Orsat's (with modifications), and a number of special appliances for the determination of fire-damp. We notice that the translator has inserted a description of Coquillon's apparatus for estimating fire-damp in mine air, which is the forerunner of the apparatus devised by Dr. Haldane, and more generally used in English mines. The latter apparatus is not mentioned; nor, so far as we have observed, is the Clowes-Redwood vapour detector, which introduces a different principle. Generally speaking, neither the German authors nor the French translator seem familiar with modern English methods and apparatus for the analysis and detection of inflammable gases. With this qualification, the treatment accorded to gas analysis is good, though readers of the "JOURNAL" may be warned that the analysis of coal gas is only referred to incidentally.

The chapter (and book) conclude with a couple of pages on the determination of the calorific power of heating and power gas. The German author mentioned only the Junkers calorimeter, but the translator has introduced a reference to the use of the Mahler bomb for the calorimetry of gases. There is no reference to the methods and apparatus devised by Professor Threlfall for determining the calorific power and composition of producer gas.

The first part of this work, as now issued, is without an index; but presumably one will be provided for the complete volume. We look forward with pleasure to the issue of the next part, in which illuminating gas, carbide and acetylene, petroleum, oils, and fats will be dealt with. But, as we have indicated, the first part contains much of direct interest to the gas-works analyst; and we cordially commend it to him.

* "Traité Complet D'Analyse Chimique appliquée aux Essais Industriels." Par J. Post, Professeur honoraire à l'Université de Gœttingne, et B. Neumann, Professeur à la technische Hochschule de Darmstadt. Traduite par le Dr. L. Gautier. Second French Edition, translated from the third German Edition, with numerous additions. Vol. I., Part I. Paris: A. Hermann; 1907.

GAS SUPPLY OF ST. GALL.

Two years ago, we were able to give some interesting particulars of the new gas-works established on the shore of Lake Constance for the supply of the town of St. Gall, Switzerland, at a distance of more than 6 miles from the works.* The new works have since been completed; and we have received from Herr Zollikofer, the Engineer of the gas and water undertakings of St. Gall, a copy of a description of the works and the subsidiary gasholder stations, together with a statement of the expenditure upon them. We have also received from him the report and accounts of the concerns for last year.

It will be remembered that the trunk main between the works and the gasholder station is about 6⅛ miles in length, and 13½ inches in diameter. Five valves are provided, so that in case of repairs being needed, a section can be readily isolated. The necessary pressure for forcing the gas through this trunk main is obtained from two Enke's No. 10 blowers, each capable of delivering 1900 cubic feet of gas per minute at a pressure of 17 inches. There is, moreover, a gain of about 6 inches in pressure *en route*, owing to the gasholder station at St. Gall being some 820 feet above the level of the gas-works. Frequently the natural pressure suffices for driving the gas through the main; and so far the blowers have been little used. The difference in level of the works and town is also responsible for a larger volume of gas being sold than is made—that is to say, the item of unaccounted-for gas disappears from the accounts, because the gas accounted for exceeds the gas made by (in 1906) 1·58 per cent.

The gas undertaking has now settled down to what seems likely to be a normal condition of supply, after the establishment of the new works on Lake Constance and the demolition of the old ones in the town, and the inclusion of a number of small communities, mostly in the vicinity of the new works, in the distributing area. These communities are supplied independently of the high-pressure main; and as they have been served for two years or more, it may be assumed that the rate of increase in the amount of gas sold is now likely to be fairly normal. The past year showed an increase of 7·6 per cent. over 1905. Of the total output of gas, 7·73 per cent. was used for public lighting, 82·76 per cent. was sold to private consumers in St. Gall, 1·37 per cent. in Goldach, 7·05 per cent. in Rorschach, and 0·44 per cent. in Arbon. Of the private consumption in St. Gall, 52·4 per cent. was in the summer months, when the price was 18c. per cubic metre; and 47·6 per cent. in the winter, when the price was 25 c. per cubic metre. Thus the average price obtained for the gas was 21·33 c. per cubic metre, or (say) 4s. 10d. per 1000 cubic feet. The cost of coal delivered at the railway station at Horn (which is connected by rail with the new gas-works) averaged 32·54 frs. per metric ton. Much difficulty was experienced, however, in getting the customary supply of coal from Germany, and some was obtained from England by way of the Rhine. But the freight charges by this route have been increased, and it is hoped it may shortly be possible to obtain English coal at a moderate rate of freight by way of Genoa or Marseilles. It is now recognized in Switzerland that it is unsafe to depend on the German coal mines, or on the German railways or waterways, for a regular supply of coal at reasonable prices.

The profit on the gas undertaking for the year was 603,043·95 frs.; and after paying interest on the capital, and making contributions to the sinking fund, the sum of 140,000 frs. (about £5600) has been handed over to the town in relief of the rates.

Some tests have been made on the flow of gas through the high-pressure main between the works and the town by Herr Zollikofer, in collaboration with Dr. A. Fliegner, of Zürich. An account of them is in course of publication by the latter gentleman; and we hope to give an abstract of his conclusions in an early issue.

* See "JOURNAL," Vol. XCI., pp. 372, 378.

On the 18th inst., the marriage was solemnized, at St. Jude's South Kensington, by the Rev. Prebendary E. A. Eardley-Wilmot, M.A., Vicar, assisted by the Rev. G. W. Gillingham, brother of the bridegroom, of Mr. James Searle Gillingham, of the Royal Corps of Naval Constructors (son of the late Mr. J. Gillingham and Mrs. Sharland, of Forest Hill), to Rose Mary, eldest daughter of Mr. and Mrs. Henry J. Robus, of Cromwell Road, South Kensington.

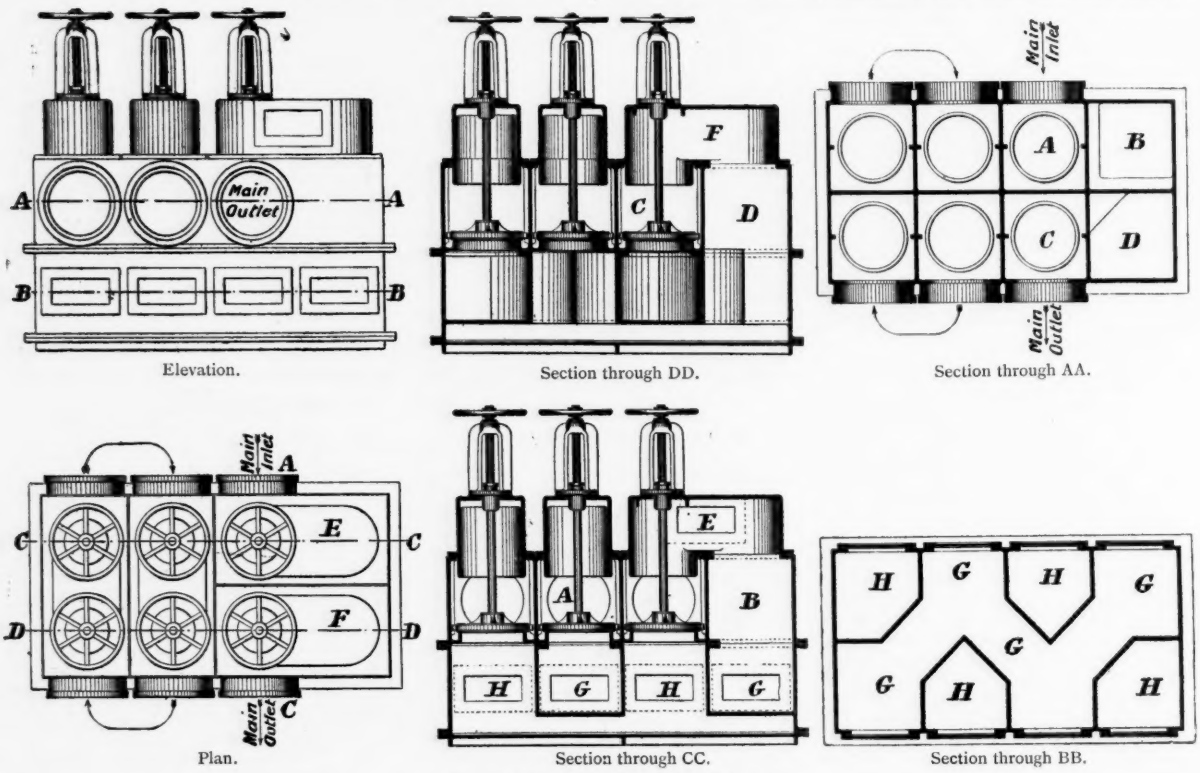
The death occurred, on Monday last week, of Dr. August Dupré, the Chemical Adviser in Explosives to the Home Office. He studied chemistry under Bunsen at Giessen and Heidelberg. Deceased, who was elected a Fellow of the Royal Society in 1875, published a number of original papers dealing chiefly with problems of chemical analysis, especially of water and food. He was a Fellow of the Institute of Chemistry, and President of the Society of Public Analysts in 1877-8. He was in his 72nd year.

REVERSING THE FLOW OF GASES THROUGH CONDENSERS AND PURIFIERS.

In these days, when engineers are considering the advisability of reversing the flow of gas through condensers and also through purifiers, it is of interest to note the latest means by which this can be brought about. We herewith give some illustrations of a reversible valve on the "Weck" system recently provisionally protected by Messrs. Robert Dempster and Sons, Limited, of Elland.

The illustrations show a valve suitable for working two condensers or two purifiers either in the usual way—that is, entering the apparatus named through the inlets and leaving through the outlets—or reversing the gas and entering the apparatus through the outlets and leaving through the inlets. In the first case, the gas must travel in one given direction (say, from right to left); in the other case, of course, the gas travels from left to right. Besides reversing the flow of the gas, the valve can be worked in the same manner as an ordinary centre-valve—that is, either one box or two boxes can be worked; but, in addition, both boxes can be bye-passed entirely by means of the valve. Although the illustrations show the valve suitable for two boxes only, it can be made for three, four, or even more boxes, and can be made in sections, if found more convenient, and bolted direct to either the condensers or the purifiers.

The difference between this valve and the ordinary type of valve consists in adding two more compartments to an ordinary valve, and fixing the main inlet and outlet sockets on the same level as the connections to the boxes to be worked, instead of below, as is usual. Connection is then made between the main inlet socket A and one of the extra compartments B, and between the main outlet socket and the other extra compartment D, by the usual hoods E and F over the top of the valve. The extra compartment B, communicating with the main inlet-socket A through the hood or connection E, also communicates with the



Dempster's Patent Reversible Valve.

main outlet chamber G in the bottom part of the valve, while the extra chamber D communicating with the main outlet socket C through the top hood F of the valve, also communicates with the main inlet portion of the valve H below. Thus, to bye-pass the valve altogether either the main inlet or else the main outlet valve is raised to the top seat, and the remainder shut down. The gas will then have to travel straight through from the main inlet to the main outlet socket without entering either the condensers or the purifiers. To work boxes Nos. 1 and 2 in the usual way through the inlets, the main inlet and main outlet valves should be raised to the top seat, and also the inlet valve to No. 1 box and the outlet valve from No. 2 box. In this case, the gas will flow through No. 1 box and then through No. 2 box and away. Or to work No. 1 box only, the main inlet and outlet valves and the inlet and outlet valves to No. 1 box should be opened to the top and the remainder of the valve shut down. No. 2 box would, of course, be worked in a similar manner by opening the valves belonging to that box instead of those belonging to No. 1 box. To reverse the flow of the gas, and to work Nos. 1 and 2 through the outlets, instead of through the inlets, the main inlet and outlet valves should be shut down on the bottom seats; the main outlet to No. 1 and the main inlet to No. 2 box shut down on the top seat; and all the other valves shut down. The gas would then pass straight from the main inlet socket into the main outlet chamber and enter No. 1 box through the outlet, come back to the valve through the inlet, go to No. 2 box through the outlet; come back to the valve through the inlet, where it would drop into the main inlet chamber; and away by the hood F through the main outlet socket C.

The valve itself is a very simple one, and of the design now generally understood throughout the country, both of which points should recommend it to the notice of gas engineers.

ACCOUNTS OF LOCAL AUTHORITIES.

Departmental Committee's Report.

Readers will doubtless remember that quite early last year a Departmental Committee was appointed by the President of the Local Government Board (Mr. John Burns) to inquire and report with regard to (1) the systems on which the accounts of local authorities in England and Wales are at present kept; (2) generally as to the system on which these accounts should be kept, and in particular whether they should be prepared on a system requiring the entries of receipts and payments to be confined as far as possible to actual receipts and payments of money or not; and (3) the regulations which should be made on the subject, regard being had to the necessity for showing accurately the amounts raised by local taxation and the purposes for which they are applied. The Committee consisted of Messrs. Walter Runciman, M.P. (Chairman), John Bromley, C.B., Thomas Pitts, C.B., Richard Barrow, Edmund Pearse Burd, John Joseph Burnly, John Gane, and Frederick Merrifield. Mr. George Rutland Snowden was appointed Secretary. The Committee held forty meetings and heard evidence from twenty-eight witnesses, of whom six were District Auditors and fourteen were nominated by the Associations of Poor Law Unions, Rural and Urban District Councils, Municipal Corporations, County Councils, the London County Council, the Institute of Municipal Treasurers and Accountants, the County Accountants' Society, the Society of Accountants and Auditors, and the Institute of Chartered Accountants. The first report of the Committee was issued last Thursday. It is signed by all the members; but Mr. Pitts adds a memorandum in which he mentions certain points in regard to which he differs from his colleagues.

The report is divided into three parts. Part I. deals with the

systems on which the accounts of local authorities are at present kept; and the conclusion arrived at by the Committee is that they are not kept on any uniform system. The chief causes of this want of uniformity are stated to be (*a*) the vague terminology of Acts of Parliament, (*b*) absence of sufficiently precise regulations and definitions, and (*c*) the increasing sense of the inadequacy of the purely cash system of keeping accounts. The Committee say there is little uniformity in regard to the form in which the abstracts of the accounts are presented to the ratepayers; and as the returns and financial statements furnished to the Local Government Board are compiled from data derived from different systems of accounts, the statistical information obtained is not uniform.

In Part II. of the report, the Committee set forth the system in which the accounts of local authorities should be kept. This is the most important part of their report; and the conclusions at which they have arrived are summarized as follows:—

(*a*) The most efficient system of account-keeping suitable for general application to local authorities is a system of income and expenditure, on which all incomings and outgoings pertaining to any given period, whether actually received and disbursed or not, are included in the accounts of that period.

(*b*) As regards rate fund accounts generally, the Committee understand that the existing law with regard to rating is such that it is not practicable at present to admit into the accounts proportionate parts of items of income and expenditure which have not actually become due for receipt or payment before the close of the financial period.

(*c*) The accounts of Overseers of the Poor, and a few classes of small authorities, are of such a character that they may continue to be limited, as heretofore, to receipts and payments of cash.

(*d*) Both for rating estimates and for statistics, a more satisfactory basis is afforded by the system of income and expenditure than by a system of cash receipts and payments.

(*e*) The actual scheme of book-keeping must necessarily be adapted to the requirements of the several authorities; but in every case it should be designed to present the accounts of the various transactions through all their stages, from first to last, in a continuous and coherent connection.

(*f*) The ledger should contain a systematic and comprehensive record of all the channels of income and expenditure, so classified that when balanced it will lead up to a clear and accurate statement of the financial position.

(*g*) Stores accounts should form an integral part of the book-keeping, and should be so framed as to afford complete touch with the materials, from their purchase to their consumption. Efficient supervision in regard to materials can only be maintained by a full system of accounts, supported by thorough and regular stocktaking, carried out independently of the officer in charge of the materials.

(*h*) Accurate and complete cost accounts should be kept in every case where an authority carries on works by direct labour.

(*i*) In respect of all trading undertakings, as defined in paragraph 65,* separate revenue accounts, net revenue accounts, and balance-sheets should be prepared.

(*k*) The balance-sheets of the several funds should be divided into separately balancing sections, and should include, as far as possible, a complete record of all assets and liabilities. These balance-sheets should finally be incorporated into an aggregate balance-sheet showing in summary the financial position of the authority as a whole.

(*l*) With regard to the depreciation of assets, the amount to be provided in any case depends necessarily on the nature of the asset itself and the special conditions attaching to it, and cannot be regulated by a general standard or scale. The repayment of debt, so far as it goes, may properly be regarded as provision for depreciation. But it is possible that the period allowed for repayment may be excessive; and therefore in some cases further provision for depreciation may be necessary.

(*m*) All assets having an abiding or realizable value, including the whole of the assets and capital outlays in respect of each trading undertaking, should be maintained in the balance-sheets at their original cost, so long as they remain in the possession of the authority. Other capital and loan expenditures—*e.g.*, on street improvements or sewers—should be written down by the amount of the provision made for the repayment of the debt.

(*n*) In regard to the financial relations of the various departments of an authority and other kindred matters, many important questions arise which cannot be settled or controlled by general regulation. The Committee recommend that all authorities of sufficient importance should be required by statute to appoint Finance Committees with general powers of control over all matters of finance and account.

(*o*) Wherever practicable, the account-keeping should be in the hands of officers who are not responsible for pecuniary transactions or administrative duties.

(*p*) Uniformity should be insisted upon, by means of regulation in regard to the general system on which the accounts should be kept.

(*q*) Complete uniformity in the presentment of accounts to ratepayers is not attainable. But it is important that the accounts should be published in a simple and easily intelligible form; and the more important authorities should also prepare fuller abstracts of their accounts for the use of ratepayers who require further information.

Part III. of the report deals with the regulations which the Committee consider should be made in regard to the accounts of local authorities. As to the more important trading undertakings of local authorities, the Committee say the regulations should provide that the results of the actual working of the undertaking, apart from loan charges, should first be shown in the revenue account, and that the loan-service and other charges not directly attributable to working should be dealt with in a separate net revenue account, which should also set out the manner in which the surplus or deficiency shown therein is treated, in accordance with the statutory requirements governing the case, and the resolution of the authority made thereunder. Separate balance-sheets should also be prepared in respect of these undertakings.

The Committee also consider that the regulations should aim at securing that reliable and uniform principles shall in all cases govern the statement of profit or loss; and the following are special points which they say should be observed in connection with these principles:—

(1) That the capital accounts are charged with true capital expenditure only, and that the decision of the loan-sanctioning authority in regard to the spreading of expenditure over a period of years is duly followed in all cases.

(2) That no valuations or appraisements of the assets are included, but that the capital outlays are maintained at their original amounts, and that the provisions made to date towards covering the cost or repaying the debt are shown *per contra* upon the balance-sheet.

(3) That the repairs and replacements of plant are charged to revenue or reserve fund in all cases, except where the original loan in regard thereto has been discharged and a further loan sanctioned.

(4) That the accounts show what provision (if any) has been made in the way of reserve, under the statutory clauses relating thereto, for meeting any special burdens which may arise in connection with replacement of plant or otherwise; and that funds which are not really available for this purpose, but are in fact required as a working balance, are not returned as reserves.

(5) That the accounts show clearly what provision has been made to cover bad debts on any uncollected income included in the accounts.

(6) That all costs connected with the undertaking are charged thereto, including a fair share of common charges which concern the management of the undertaking, all law and parliamentary costs, all bank charges, discounts, and expenses in respect of the issue of stock, and other financial charges.

(7) That the accounts include the full amount of all running charges or income accrued during their period, such as the proportion of all loan-service charges accruing between the last date for payment and the close of the account.

(8) That the accounts of the period are charged with their proper share of loan repayment or sinking fund provision in respect of all expenditure charged upon loan account, and that the incidence of this burden is not deferred by delay in taking up loans or by meeting capital expenditure by bank overdraft. A proper share of the expenditure should be charged to the revenue account in cases where unavoidable delays arise in obtaining the loans.

(9) That where capital expenditure relates to other matters in addition to trading undertakings, or to more than one undertaking—*e.g.*, to tramways and street improvements, or to electricity and dust destruction—a reliable and, if possible, independent apportionment of the burden shall be obtained.

(10) That where transfers have to be made in respect of services rendered by one department to another, as in the case of gas or electric current supplied for the lighting of streets, sufficient data are provided to establish the fair and reasonable nature of the charge.

On the subject of the published abstracts and financial statements, the Committee express the opinion that the regulations should deal with the form in which the abstracts are to be published; for they regard it as highly desirable that one pattern for each class of authority should be followed in the outline and arrangement, with the view of making the abstracts as useful and easy of comprehension as possible to all persons interested therein. In the schedules to the report are given standard forms of abstracts of electricity, gas, water, and tramway accounts which the Committee believe will be suitable for publication by local authorities who possess these undertakings;* and they consider that clear regulations on the lines indicated will not only secure the preparation of the accounts on uniform principles and their publication in an easily intelligible form, but furnish both the staff of the authority and the auditors with adequate means for verifying their accuracy and completeness.

In conclusion, the Committee draw attention to certain points on which some alteration of the existing statutes may be involved in giving the fullest effect to their recommendations. In the first place, they think it desirable that the systems of account for all local authorities should be prescribed by one central authority. Next, the general appointment of Finance Committees and the settlement of their functions in regard to financial questions may call for some amplification of the existing provisions. The two following points with regard to the law of rating touch the fringe of much wider questions; and therefore the Committee's suggestions are based only upon considerations of accountancy. They understand that, under the existing law with regard to rating, the complete system of income and expenditure cannot be applied to funds which consist mainly or entirely of rates. In their opinion, the ratepayer of any given year should be charged with the "expenditure" of that year—*i.e.*, with the total cost of the year's operations, so far as it can be estimated in advance, and so far as it is not authorized by sanctions of loans to be spread over a series of years. The other point is that considerable simplification of accounts, and greater uniformity, could, the Committee think, undoubtedly be obtained by a general unification of the existing systems of rating and assessment.

* The Committee explain, in the paragraph referred to, that the term "trading undertakings" may be taken to mean gas-works, water-works, electricity, tramway, and light-railway undertakings.

* We reproduce on pp. 230-31 the proposed standard form of abstract of gas-works accounts.

STANDARD FORM OF ABSTRACT OF GAS-WORKS ACCOUNTS FOR PUBLICATION BY LOCAL AUTHORITIES.

[See Report of Departmental Committee on p. 228.]

(*Name of Local Authority.*)

(*Title of Order or Act under which the Undertaking was established by the Local Authority.*)

I.—STATEMENT AS TO BORROWING POWERS.

Borrowing Powers Authorized.			Borrowing Powers Exercised.	Borrowing Powers Remaining to be Exercised.
Act, Order, or Sanction.	Period of Loan.	Amount.		
		£	£	£

II.—REVENUE ACCOUNT for Year ended _____, 19 .

Dr. *Cr.*

Expenditure.	£ s. d.	£ s. d.	£ s. d.	*Income.*	£ s. d. Corporation Depts.	£ s. d. All other Consumers.	£ s. d.
MANUFACTURE OF GAS.							
1. Carbonization—							
Coal and all expenses of depositing same on works				SALE OF GAS—			
Wages of stokers				1. Private Consumers			
2. Purification—				2. Public Lamps			
Wages							
Materials, water, and other expenses				Total in respect of Gas Sales			
3. Salaries of officials—							
Engineers, Superintendents, and Officers at Works				RESIDUAL PRODUCTS—			
4. Repairs and Maintenance—				3. Coke			
Buildings				4. Tar			
Plant, including Retorts and Apparatus				5. Ammoniacal Liquor			
5. General Charges—				6. Other products			
Oil, water, waste, and engine-room stores							
RESIDUAL PRODUCTS—				RENTALS OF METERS, FITTINGS, AND STOVES—			
6. Charges in connection therewith				7. Meters			
				8. Fittings			
DISTRIBUTION OF GAS—				9. Stoves			
7. Salaries of Engineers, Inspectors, and Assistants							
8. Wages of meter inspectors				PUBLIC LAMPS—			
9. Repairs and maintenance:—				10. Lighting and Repairing			
(*a*) Mains and services							
(*b*) Meters				SUNDRY REVENUE—			
PUBLIC LAMPS—				10. Works executed for customers, and goods sold			
10. Lighting and repairing				11. Rents, wayleaves, and easements			
				12. Miscellaneous			
RENTS, RATES, AND TAXES—				.....			
11. Rents, wayleaves, and easements				.....			
12. Rates and taxes							
MANAGEMENT AND GENERAL EXPENSES—							
13. Salaries of Engineer, Manager, Secretary, and Office Staff (not charged elsewhere)							
14. Proportion of salaries and establishment expenses of Town Clerk's, Treasurer's, and other departments							
15. Salaries and expenses of collectors separately appointed							
16. Printing, stationery, and advertising							
17. Other establishment charges							
18. Law charges							
19. Insurances and compensations							
20. Miscellaneous							
GAS STOVES AND FITTINGS—							
21. Stoves and fittings							
22. Wages and materials				Gross income			
SUPERANNUATION—							
23. Allowances to officers and servants				*Less*—Discounts and other allowances			
Total amount of working expenses				Bad debts written off			
Balance carried to net revenue account (No. III.)							

Note.—It will be understood that additional items may be inserted in these forms, where required, provided the general classification is preserved.

III.—NET REVENUE ACCOUNT for Year ended _____, 19 .

Dr. *Cr.*

Expenditure.	£ s. d.	*Income.*	£ s. d.
To interest on loans (including income-tax)		By Balance 1st April, 19 , brought forward	
,, loans funds, redemption funds, and sinking funds—Amount transferred thereto		,, Revenue account (No. II.)—Amount transferred therefrom	
,, Instalments of loans		,, Bank interest	
,, Parliamentary expenses		,, Borough (or District) fund—Amount of deficiency (if any) transferred therefrom	
,, Renewals fund—Amount transferred thereto			
,, Reserve fund—Amount transferred thereto			
,, Borough (or District) fund—Amount transferred thereto in aid of rates			
Balance (if any) at 31st March, 19 , to be carried forward			

Dr. **IV.—SINKING FUND ACCOUNT for year ended _____, 19 .** *Cr.*

Expenditure.	£ s. d.	£ s. d.	*Income.*	£ s. d.
To Redemption of Loans—			By Balance, 1st April, 19 , brought forward	
.....			,, Dividends on Investments	
.....			,, Net Revenue Account—Amount transferred therefrom	
Balance, 31st March, 19 , to be carried forward				

Dr. **V.—RENEWALS FUND ACCOUNT for year ended _____, 19 .** *Cr.*

	£ s. d.	£ s. d.	*Income.*	£ s. d.
To Renewals, viz.—			By Balance, 1st April, 19 , brought forward	
Balance, 31st March, 19 , to be carried forward			,, Dividends on Investments	
			,, Net Revenue Account—Amount transferred therefrom	

Dr. **VI.—RESERVE FUND ACCOUNT for year ended _____, 19 .** *Cr.*

	£ s. d.	£ s. d.	*Income.*	£ s. d.
To Amounts applied (*specifying them*)—			By Balance, 1st April, 19 , brought forward	
.....			,, Dividends on investments	
.....			,, Net Revenue Account—Amount transferred therefrom	
Balance, 31st March, 19 , to be carried forward				

Dr. **VII.—CAPITAL ACCOUNT, year ended _____, 19 .** *Cr.*

Expenditure.	To 31st March, 19 .	From 1st April, 19 , to 31st March, 19 .	Total.	*Loans and Credits.*	To 31st March, 19 .	From 1st April, 19 , to 31st March, 19 .	Total.
	£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.
To acquisition of undertaking where acquired from Company				By Loans Raised, viz.—			
,, Land				Stock—			
,, Buildings				.....			
,, Manufacturing plant, machinery, &c.				.....			
,, Mains and services				Mortgages—			
,, Meters				.....			
,, Stoves				.....			
,, Offices and depôts				Annuities (capitalized value)—			
,, Office furniture				.....			
,, Parliamentary expenses				.....			
,, Preliminary expenses				[*The basis on which the value is arrived at should be stated.*]			
Balance unexpended at 31st March, 19				,, Revenue Contributions to Capital—			
				.....			
				.....			
				,, Other Items, viz.—			
				Note.—The proceeds of realizations or sales of property should be shown as deductions from the specific items on the other side of the account, where statutory provisions do not prescribe a different treatment.			

VIII.—BALANCE-SHEET as at _____, 19 .

Liabilities.	£ s. d.	£ s. d.	*Property Assets and Outlay.*	£ s. d.	£ s. d.
Loans—			Capital Outlay as per Capital Account—		
Stock (at par value)			Acquisition of undertaking where acquired from Company		
Mortgages			Land		
Annuities (capitalized value)			Buildings		
[*The basis on which the value is arrived at should be stated.*]			Manufacturing plant, machinery, &c.		
Sundry Creditors—			Mains and services		
.....			Meters		
.....			Stoves		
.....			Offices and depôts		
Total liabilities			Office furniture		
Renewals Fund—			Parliamentary expenses		
(Balance at credit thereof)			Preliminary Expenses		
Reserve Fund—					
(Balance at credit thereof)				£ s. d.	
Net Revenue Account—			Works in progress—		
(Balance at credit thereof)			.....		
Revenue Contributions to Capital			.....		
Redemption of Debt—			Stores on Hand—		
Debt extinguished			.....		
Sinking fund available			.....		
			Investments (at cost)—		
			.....		
			.....		
			Sundry Debtors—		
			.....		
			.....		
			Cash—		
			.....		
			.....		

COMPARISONS OF LIGHT-STANDARDS.

REPORT MADE BY THE NATIONAL PHYSICAL LABORATORY TO THE INSTITUTION OF GAS ENGINEERS.

[Presented by Mr. C. C. Paterson to the International Photometric Committee at Zurich last Thursday.]

In the comparisons which have been made at the National Physical Laboratory between the Pentane, Hefner, and Carcel lamps, special precautions have been taken to use them, as far as could be ascertained, in accordance with the regulations and practice observed in the countries where they are employed as standards. Details as to the methods of use and the precautions taken when burning the lamps are given in this report.

Lamps Used in Tests.

Two Carcel and two Hefner lamps (the latter certified by the German Reichsanstalt) were employed in the tests, and were compared against the standard 10-candle pentane lamp at the National Physical Laboratory. This lamp, which, in all its dimensions, agrees accurately with the specification and has passed the Gas Referees' examination, is used in the course of ordinary laboratory test work for the purpose of standardizing other pentane lamps which are sent from time to time to be tested. The comparisons during 1904 and 1905 between this standard and lamps from different makers are given below, for the purpose of showing the smallness of variations occurring in different lamps made to the same specification, and also to show that the pentane lamp used for these comparisons may safely be taken as having a value of exactly 10 candles.

Pentane Lamp.	Candle Power when compared against National Physical Laboratory Standard Lamp.
A	9·96
B	10·00
C	9·98
D	9·98
E	10·05
F	10·00
G	10·00
Average	10·00

General Conduct of Test.

As part of the equipment of the photometric department, a large number of electric carbon filament lamps have been carefully calibrated against the standard pentane lamp under circumstances which are described later. These electric lamps form the primary working standards of the Laboratory, and are checked from time to time among themselves and also against the 10-candle lamp. Some are burnt only once or twice a year, and others more frequently; but none are used for more than 5 or 10 minutes at a time. The candle power of these is known accurately in terms of the pentane unit, and they have been used in all cases as a means of intercomparison between three flame-standards. The pressure on these is adjusted by the potentiometer.

The "double comparison" method has been employed in all the daily observations which have been made. That is to say, an electric lamp, selected on account of the suitability of its light colour, is first calibrated against the primary electric standards in terms of the 10-candle pentane lamp. This lamp remains on the bench while the primary standard is replaced by the flame lamp to be tested, and measurements of candle power are made on it. The comparison lamp is checked each day against the primary standards, and is only assumed to remain constant for the few hours during which the test is in progress. By this means the "personal error" in judging the correct position of the balance is eliminated, as well as any possible error which may result from differences in reflection from the screens surrounding the lamps at the two ends of the bench. In measuring the Carcel and pentane lamps against the electric standards, the illumination on the photometer screen was 10 candle-metres (about 1 candle-foot). This had to be reduced in the case of the Hefner lamp to about one-third of a candle-metre, on account of the small candle power of the amyl-acetate lamp. Special precautions were taken to ensure thorough ventilation of the photometer-room immediately before the readings were taken, and freedom from draughts when the observations were in progress.

Variations of Candle Power with Changes in Atmospheric Conditions.

It is now universally recognized that the candle power of flame-standards varies to a considerable extent according to the amount of humidity present in the atmosphere, and also with changing barometric pressure. This was first definitely shown by the researches of Herr Liebenthal at the Reichsanstalt, which were published in 1895. His experiments were made on the Hefner lamp and the 1-candle Woodhouse and Rawson pentane standard. The results of these formed the basis upon which the candle power of the Hefner lamp was taken as unity, with a humidity of 8·8 litres of moisture per cubic metre of pure air. In the standardization of the National Physical Laboratory primary electric standards referred to above, a similar set of experiments has been made on the 10-candle power Harcourt lamp, with the object of determining, in the same way, its variation with humidity and barometer; and a water vapour content of 10 litres per cubic metre has been fixed upon as the humidity at which the lamp has its nominal value of 10 candles. [Ten litres per cubic metre is the mean humidity for five years observed at the Meteorological Office in Victoria Street, London, and at the National Physical Laboratory's Department at Kew.]

In view of the fact that these standard humidities are different in Berlin and London, it was not sufficient for our measurements merely to compare the lamps on the same day, regardless of the humidity value—even if the latter could have been assumed to remain constant during the experiment, and the correcting factor the same for all the lamps—but the change in candle power of each lamp with atmospheric moisture had to be determined independently, and the candle power deduced at standard humidity and barometer by means of the formula obtained from all the observations.

In the use of all the three lamps the readings were not taken till 40 minutes after lighting up. The photometer room was thoroughly ventilated; observations being made during the first 20 minutes after shutting the windows and doors.

Results of Experiments.

The results of these measurements are shown graphically for the pentane, Hefner, and Carcel lamps respectively in diagrams, figs. 1, 2, and 3. The scales are the same for all three lamps; so that the curves are comparable at sight. The humidity content of the air is plotted as abscissa; and the candle power of each lamp, in terms of the 10-candle pentane unit, is plotted vertically as ordinates—observations having been previously corrected to a barometric pressure of 760 mm. of mercury. The humidity and barometer correcting factors have been obtained by the method of least squares from all the observations plotted in figs. 1 and 2.

It is a matter of regret to us that, owing to the session of the International Commission in June, we are unable, in the case of the Hefner and Carcel lamps, to embody the results of comparisons at higher humidities in this report. The maximum humidity obtainable up to the middle of May has been 12 litres per 1000. In view, however, of the fact that the humidity factor found for each Hefner lamp independently (see the curves on the right-hand side of fig. 2) is so nearly the same, we are of opinion that observations over a still wider range will not materially alter its amount. It may be pointed out here, however, that, as our observations all lie in the neighbourhood of the standard humidity (8·8 litres), the absolute correctness of this factor will not affect the value given for the ratio between the candle power of the two lamps. The correcting formula for humidity in the case of the Hefner lamp is

$$\text{Candle power (Hefner units)} = 1{\cdot}000 + 0{\cdot}0066\,(8{\cdot}8 - \epsilon)$$

where ϵ = litres of water vapour per cubic metre of pure air.

The values shown on fig. 1 for the pentane lamp were made at intervals over a period of two years, and give the same constant —viz.,

$$\text{Candle power (pentane units)} = 10 + 0{\cdot}066\,(10 - \epsilon)$$

where ϵ = litres of water vapour per cubic metre of pure air.

As regards the correction for barometer, the following values were obtained for the two Hefner lamps:—

$$\text{Candle power (Hefner lamp No. 1117)} = 1{\cdot}000 - 0{\cdot}00030\,(760 - b)$$

and

$$\text{Candle power (Hefner lamp No. 960)} = 1{\cdot}000 - 0{\cdot}00012\,(760 - b)$$

where b = reading of barometer in mm.

The slight discrepancy in these constants is undoubtedly due to the smallness of the correction, coupled with the comparatively small range of barometric pressure over which we were able to observe the lamp. If a mean factor 0·0002 be accepted, the difference in the candle power between this and the factor 0·00012 for a 20 mm. change in barometer amounts to under 0·2 per cent.; the total correction being about ½ per cent. for 25 mm.

The barometric correcting formula for the pentane lamp is:—

$$\text{Candle power (pentane units)} = 10 - 0{\cdot}008\,(760 - b).$$

So that, combining all the formulæ given above:

$$\text{Candle power (Hefner lamp in Hefner units)} = 1{\cdot}000 + 0{\cdot}0066\,(8{\cdot}8 - \epsilon) - 0{\cdot}0002\,(760 - b)$$

$$\text{Candle power (pentane lamp in pentane units)} = 10{\cdot}00 + 0{\cdot}066\,(10 - \epsilon) - 0{\cdot}008\,(760 - b)$$

From the curves shown in figs. 1 and 2, it will be seen that the ratio of the pentane lamp burning in an atmosphere containing 10 litres of moisture per 1000 to that of the Hefner lamp burning in air containing 8·8 litres per 1000 is—

$$\frac{\text{Pentane}}{\text{Hefner}} = \frac{10}{0\,914} = 10{\cdot}95.$$

That is to say, if the pentane lamp be taken as giving 10 candles, the Hefner lamp will have a value of 0·914.

In addition to the direct comparison between the Hefner and pentane lamps (details of which are given in the foregoing report), we have had occasion to compare the Hefner lamp as used in the Reichsanstalt with the pentane lamp as used at the National Physical Laboratory, through the medium of some electric lamps which have been standardized at both Institutions. These, though not entirely consistent, point to a ratio of pentane to Hefner which is somewhat greater than 10·95. Arrangements

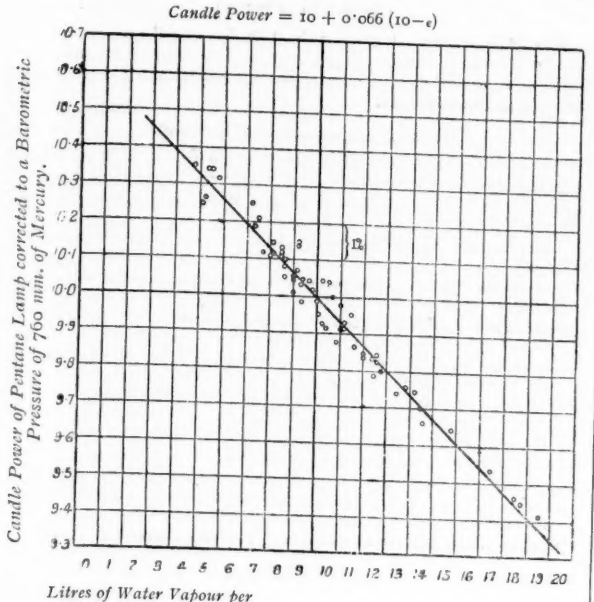

Candle Power = 10 + 0·066 (10−ϵ)
Candle Power of Pentane Lamp corrected to a Barometric Pressure of 760 mm. of Mercury.
Litres of Water Vapour per Cubic Metre of Pure Air = ϵ.

Fig. 1.—Ten-Candle Harcourt Pentane Lamp—Variation of Candle Power due to Humidity.

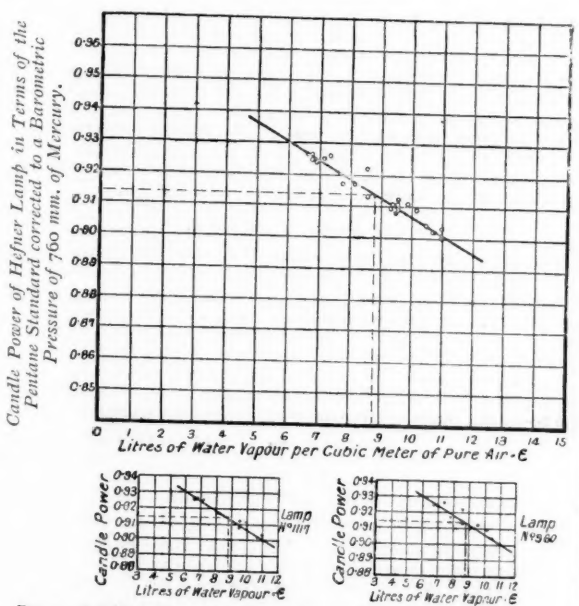

Candle Power of Hefner Lamp in Terms of the Pentane Standard corrected to a Barometric Pressure of 760 mm. of Mercury.
Litres of Water Vapour per Cubic Meter of Pure Air-ϵ
Candle Power
Lamp N°1119
Lamp N°960
Litres of Water Vapour-ϵ

Fig. 2.—Hefner Lamp—Variation of Candle Power due to Humidity.

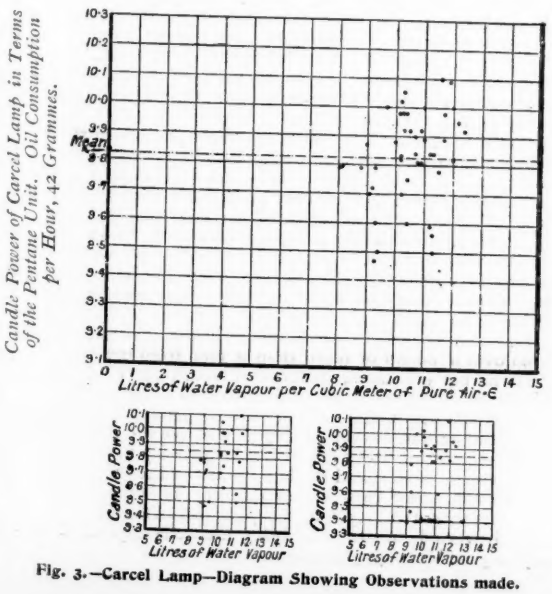

Candle Power of Carcel Lamp in Terms of the Pentane Unit. Oil Consumption per Hour, 42 Grammes.
Mean
Litres of Water Vapour per Cubic Meter of Pure Air-ϵ
Candle Power
Litres of Water Vapour

Fig. 3.—Carcel Lamp—Diagram Showing Observations made.

have been made for a further direct comparison through some standardized lamps which Mr. Paterson proposes to take to Berlin, and we hope to communicate further with the Institution when the matter has been investigated.

Tables are appended showing in Column 1 the candle power of the pentane and Hefner lamps as observed, in Column 2 the candle power when corrected by the formulæ for humidity and barometer, and in Column 3 is given the percentage deviation of the observed value from that which would be obtained by the use of the correcting formula—these figures being a measure of the accuracy of observation in the experiments.

TABLE I., *Giving the Observed and Corrected Values for the* 10-*Candle Harcourt Pentane Lamp from December*, 1903, *to March*, 1905.

(1.) Observed Value of Candle Power.	(2.) Candle Power Corrected for Humidity and Barometer.	(3.) Percentage Difference Between Value Given by the Formula and Observed Value.	(1.) Observed Value of Candle Power.	(2.) Candle Power Corrected for Humidity and Barometer.	(3.) Percentage Difference Between Value Given by the Formula and Observed Value.
9·86	10·04	+0·4	10·14	9·99	−0·1
9·64	10·02	+0·2	10·15	10·00	0
9·91	10·04	+0·4	10·35	9·99	−0·1
9·89	10·03	+0·3	10·30	9·99	−0·1
9·97	10·00	0	9·79	10·00	0
9 88	10 04	+0·4	9·90	9·98	−0·2
9·86	10·05	+0·5	9·79	10·00	0
10·01	9·99	−0·1	9·78	9·99	−0·1
10·01	10·01	+0·1	10·05	9·99	−0·1
10·00	10·01	+0·1	9·84	9·98	−0·2
9·92	10·04	+0·4	9·76	10·01	+0·1
9·97	10·00	0	9·97	10·03	+0·3
10·20	9·95	−0·5	10·20	9 99	−0·1
10·19	9·95	−0·5	10 01	10·02	−0·2
10·10	9·99	−0·1	9·76	10·01	+0·1
10·06	9·99	−0·1	10·15	10·03	+0·3
10·04	10·04	+0·4	9·84	10·01	+0·1
10·37	10·00	0	9·80	9·85	−0·5
10·27	10·05	+0·5	10·06	10·04	+0·4
10·29	10·04	+0·4	9·83	9·98	−0·2
10·34	9·97	−0·3	9·75	10·00	0
10·36	9·98	−0·2	9·69	9·97	−0·3
10·36	9·98	−0·2	9·46	10·02	+0·2
10 25	9·96	−0·4	9·43	10·01	+0·1
10·10	10·05	+0·5	9·41	10·05	+0·5
9·98	9·98	−0·2	9·82	10·01	−0·1
9·98	9·96	−0·4	9·69	10·03	+0·3
9·92	9·97	−0·3	9·54	10·03	+0·3
9·98	9·95	−0·5	9·88	9·95	−0·5
10·20	10·01	+0·1	9·81	9·96	−0·4
10·21	9·99	−0·1	9·86	9 97	−0·3
9·85	10 03	+0·3	10·08	10·00	0
9·89	10·00	0	10·10	10·04	+0·4
10·08	9·99	−0·1	10·15	10·04	+0·4
10·06	10·00	0	9 92	9·98	−0·2
9·60	10·03	+0·3	9·80	10·02	+0·2
10·16	9·97	−0·3	10·01	10·07	+0·7
9·94	10·02	+0·2	10·13	10·04	+0·4
9·97	10·01	+0·1	10·03	10·02	+0·2

TABLE II., *Giving the Observed and Corrected Candle Power Values for the Hefner Lamps from February to May*, 1905.

(1.) Observed Value of Candle Power.	(2.) Candle Power Corrected for Humidity and Barometer.	(3.) Percentage Difference Between Value Given by the Formula and Observed Value.	(1.) Observed Value of Candle Power.	(2.) Candle Power Corrected for Humidity and Barometer.	(3.) Percentage Difference Between Value Given by the Formula and Observed Value.
0·919	0·915	+0·1	0·916	0·912	−0·2
0·911	0·912	−0·2	0·902	0·908	−0·6
0·905	0·917	+0·3	0·906	0·915	+0·1
0·915	0·917	+0·3	0·915	0·917	+0·3
0·914	0·918	+0·4	0·912	0·919	+0·5
0·911	0·914	0	0·912	0·914	0
0·913	0·914	0	0·925	0·921	+0·7
0·904	0·914	0	0·913	0·912	−0·2
0·927	0·912	−0·2	0·902	0·914	0
0·922	0·913	−0·1	0·925	0·912	−0·2
0·928	0·913	−0·1	0·927	0·912	−0·2
0·917	0 911	−0·3	0 923	0·916	+0·2

Great difficulty has been experienced in obtaining consistent results from the Carcel lamp. Efforts were first made to use the lamp in accordance with the printed instructions, having the wick 10 mm. above the wick-holder and the chimney neck 7 mm. above the wick. Under these conditions, however, it was not found possible to keep the oil consumption below 50 grammes per hour; and after communicating with M. Vautier (whose reply is given in the appendix), the lamp was used with the wick 8 mm. above the holder and the chimney 7 mm. above the wick—thus reducing the consumption to about 42 grammes per hour. Upwards of 100 independent observations have been made on it, and attempts made to bring the measurements more into line by using different chimneys and by taking the average of several readings in different directions round the lamp. But the observations which are plotted on fig. 3 point to the fact that the constancy of the lamp cannot be depended upon to within 3 per cent.; and attempts to deduce a correcting formula for variations in humidity and barometer would be quite useless. The individual observations are therefore merely plotted in fig. 3 to serve as a comparison with figs. 1 and 2. The results obtained from the

lamps individually are shown on the right-hand side; and by taking the mean of each of these sets of observations, the following values will result:—

Candle power (Carcel lamp 1 in pentane units) = 9·80
" (" 2 " ") = 9·85

which, taking the mean, gives the following ratio:—

$$\frac{\text{Pentane}}{\text{Carcel}} = \frac{10}{9{\cdot}825} = 1{\cdot}018$$

—viz., the Carcel being about 2 per cent. less than the 10-candle pentane lamp.

Notes on the Use of the Standard Lamps.

The Pentane Lamp.

The pentane lamp was set up and used in accordance with the instructions given in Appendix A of the Notification of the Metropolitan Gas Referees; the height of the flame being accurately adjusted in all measurements to a point half-way between the bottom of the mica window and the cross-bar. Adjustment was made by regulation of the air-inlet to the saturator. The pentane used was obtained in several different consignments from Mr. S. E. Miller, of Oxford, and conformed in all respects with the tests given in Appendix B of the Notification. The residues in the saturator were removed from time to time after the lamp had been in use about a fortnight. Both in the use of the pentane and Hefner lamps a second observer watched the flames of the lamp under test, and notified when it was burning at the correct height. For the purpose of reference, copies of the appendices mentioned accompany the report.

The Hefner Lamp.

The Hefner lamps used in the comparisons were those numbered 960-1902 by Siemens and Halske, and 1117-1904 by S. Elster; both having been certified at the Reichsanstalt in Berlin. The amyl-acetate used in the tests was obtained from the Chem. Tech. Prüs. and Versuchs-Anstalt, Karlsruhe—being certified by them for use with the Hefner lamp, and was found by us to pass the requisite tests for purity. The wick used was also supplied with the lamps, and fitted easily into the wick-tubes. The height of the flames was adjusted to 44 mm. with the optical device that is supplied for the purpose; the amyl-acetate being emptied out and changed from time to time during the tests. The instructions and precautions to be observed when using the lamp are given in the *Zeitschrift für Instrumentenkund*" for July, 1893, and were carefully attended to in all our experiments with it.

The Carcel Lamp.

For instructions and precautions to be observed in the use of the Carcel lamp, we are indebted to M. Vautier, of Lyons, who has kindly furnished us with details of the practice which is followed in the French gas-testing stations. The two lamps were used on one of the standard balances supplied for the purpose; their dimensions being found to agree with the measurements given in " L'instruction pratique donnant la marche à suivre pour les expériences relatives à la determination journaliére du pouvoir éclairant," a copy of which accompanies this report. The instructions given in the pamphlet were followed in the use of the lamp, with the exception that, in order to bring the consumption of the oil within the requisite limits, the wick was lowered to within 8 mm. of the wick-holder; the neck of the chimney remaining 7 mm. above the top of the wick. By this means, the oil consumption was kept to within 40 and 46 grammes per hour—the candle power at each observation plotted on fig. 3 having been previously corrected to that which would be equivalent to 42 grammes per hour. The wicks were kept in a desiccator until just before use, and a fresh wick was used for each experiment. The colza oil and wicks employed in the tests were obtained from France; being the same as those used in the Paris testing-stations. The instructions and recommendations for lighting the lamp, which have been kindly supplied to us by M. Vautier, are copied from his letter and given in the appendix at the end of this report. Precautions were taken, as far as possible, to prevent contact of air with the oil in the bottles in which it was stored. It was also changed in the lamps every two days, and the iodine number for the residues found to have remained the same as that of the fresh oil.

Comparison and Criticism of the Three Lamps as Standards of Light.

The comparisons which we have made between the three principal flame standards now in use have given us opportunities for comparing them under working conditions and judging of their relative suitability as standards of light.

As regards the Carcel lamp, we have not found that its constancy from day to day is comparable with that of either the Hefner or pentane lamps; its variations from the mean being as much as + or − 3 per cent., the reason for which we can only attribute to difficulty in reproducing the same conditions of capillarity in the wicks used. Though all possible care was taken in our measurements to produce the most favourable conditions of constancy, the results were not satisfactory; and in the notes which follow, the pentane and Hefner lamps only are considered with reference to their suitability as light standards.

General Construction.

The Hefner lamp, having only $\frac{1}{11}$th the candle power of the pentane, is much simpler in general construction, small, and more easily set up, and should be simpler to manufacture and adjust to standard dimensions.

Ease of Regulation and Working.

We have found in using the lamp that the flame of the 10-candle pentane standard is a great deal easier to adjust, and remains more constant while observations are being made, than that of the amyl-acetate lamp.

The fact that the Hefner unit has a lambent flame burning in free air, whereas the pentane standard is well shielded and, owing to its chimney, has a more stable flame. makes the latter practically independent of the draughts which would render measurements with the Hefner lamp quite impossible. Though the flame of the Hefner lamp was screened from draughts in our measurements, slight movements of the air cannot be avoided. These disturb the flame so that it only remains at its correct height for a few seconds together, rendering adjustment difficult and the taking of candle power readings rather a tiring process. On the other hand, it is not safe to assume that, owing to the cutting off of the top of the flame of the pentane lamp, the latter may be allowed to vary appreciably in height. Variations of 3 mm. up or down do not materially affect the candle power; but for accurate work a second observer is required to see that the top of the flame is flat, and regulate it to the correct height.

Reproducibility.

As far as accuracy in candle power is concerned in different lamps made to the same specification, we have only had the opportunity of examining the two Hefner lamps mentioned in this report, and the candle power of which we have found identical. The remarks made in the opening paragraphs show that, with pentane lamps manufactured with ordinary care, the largest variation in illuminating power which may be expected is $\frac{1}{2}$ per cent. Lamps which adhere rigidly to specification agree to a greater accuracy than this. We have used different samples of pentane which come within the limits of specific gravity prescribed, and have not noticed more than 0·4 per cent. difference in candle power due to this cause. The amyl-acetate used was all from the same consignment from Karlsruhe. As far, therefore, as our experiments show, we find little to choose between the two standards on the score of reliability of reproduction.

The Nature of the Light.

The pentane lamp has a whiter light than the Hefner unit; being much more nearly of the same tint as the Carcel standard. The fact that its candle power is eleven times that of the amyl-acetate lamp, makes it of the same order of candle power as the ordinary lights which are tested against it. These two factors, coupled with the greater ease of adjustment when making observations, have greatly outweighed, in our opinion, the disadvantage of more complicated construction, and led to the adoption of the 10-candle pentane lamp by us as the primary standard of light.

(Signed) R. T. Glazebrook, Director.

Appendix.

Translation of Extract from Letter by M. Vautier, giving Instructions and Precautions to be observed in the Use of the Carcel Lamp.

We have also observed that the Carcel lamp burns more oil than the quantity specified, when the height of the wick is 10 mm. To avoid this difficulty, we regulate the height of the wick to 7 or 8 mm.; and we put the chimney at about 7 mm. above the upper edge of the wick. Under these conditions, the Carcel lamp burns very approximately 42 grammes of oil. A slight variation in the height of the wick from the chimney, within the limits above specified, is sufficient to bring the consumption of oil to very nearly 42 grammes. We have noticed that the influence of a slight modification of the wick is about three times as great as the corresponding movement of the chimney. The following information may perhaps also be of interest to you.

The wick should be first cut clean and square with the wick-holder, and well saturated with oil. It is then raised to about 12 mm. above the wick-holder. It is well and uniformly lighted by means of a batswing gas-flame, with its flat surface held horizontally. When a charred ring of about 2 mm. in height has been obtained, the chimney is rapidly placed on its support, the wick is lowered to 7 or 8 mm., and the chimney is lowered to the same height as the wick, which makes the lamp burn with a depressed flame. The lamp is left burning in this manner for a few minutes. The flame ought to be quite regular; and the charred ring should also be of uniform height. The wick ought not to be charred over a height of more than 2 mm. from the application of the batswing gas-flame, otherwise it would not be possible to bring the consumption of oil to the amount of 42 grammes. After the lamp has burnt in this manner with the flame depressed some minutes, the chimney is raised to 7 mm. above the upper edge of the wick—the latter being left at the height of 7 to 8 mm. The flame increases in size, and the lamp is allowed to burn for about 20 minutes in order that it may take up its normal condition. During this time, the height of the wick and of the chimney may be slightly varied, in order to bring the consumption of oil as nearly as possible to 42 grammes.

STANDARD TEST BURNER FOR LONDON GAS.

By Charles Carpenter and James W. Helps.

[A Paper read by Mr. Helps before the International Committee on Photometry at Zurich last Saturday.]

When communicating to the first session of this congress a note upon "An Improved Photometer for Testing Incandescent Burners," the authors took occasion to express their satisfaction that the official mode of photometry prescribed in London had at last been based upon the method of Dumas and Regnault.

Since the year 1869, when Sugg's "London" argand was first prescribed by the Metropolitan Gas Referees as the standard burner to be used for testing the gas supplied to the Metropolis, it had been used with a fixed gas consumption of 5 cubic feet per hour. The unscientific method of so using it was well known by all experimentalists; but it was not until the year 1900 that the South Metropolitan Gas Company were able to persuade the Legislature to adopt the more rational Parisian method devised by the eminent French savants in 1861. The victory of reason over prejudice was not long unchallenged.

The control of the gas supply to London is in the hands of three bodies: First, the Legislature, which enacts what shall be the quality, and lays down the principles to be observed in testing it; second, the Metropolitan Gas Referees, who prescribe the apparatus to be used for this purpose; and, third, the London County Council, who are the authority for carrying out the testings. The officials of the last-named body regarded with dissatisfaction the adoption by the Legislature in 1900 of the Parisian method of using the standard burner; and, owing to their representations, a Committee of the Board of Trade (presided over by Lord Rayleigh) was appointed to consider *inter alia* whether this method or a 5 cubic feet fixed rate of gas consumption should be adopted. The Committee recommended the latter course; and the London County Council forthwith presented a Bill to Parliament to legalize that mode of testing.

The measure passed the House of Commons; but the House of Lords, to whom in turn the Bill was submitted, made an important modification in the original proposal. They accepted the principle of consuming the gas at the fixed rate of 5 cubic feet per hour, but stipulated that the burner and its use were to be such as to obtain from the gas the greatest amount of light. As a result of this decision, experiments were made by the South Metropolitan Gas Company in order to produce a burner which would comply with these conditions. The tri-current argand burner was already used in some English towns as a standard; and with it investigations were carried out based upon measurements of the air currents flowing to its flame through each of the three channels provided in its design. The apparatus used for this purpose is shown in figs. 1, 5, and 7,* and was arranged as follows: The burner was fixed at the head of a conical chamber divided into three concentric compartments having at the base of each a perforated baffle with a "hit-and-miss," by which the flow of air could be regulated with exactitude. Air from a balanced holder was passed through three suitable meters, and the quantity required to obtain the best result from the gas under test, when consumed at the rate of 5 cubic feet, was ascertained by a process of trial and rejection. The correct dimensions were finally obtained, from which a burner was constructed in which might be produced the same results with a natural but regulated draught. This burner has been named "The 'Metropolitan' Argand Burner No. 2."

In Table A are given the results of some experiments which will show to what extent it reaches the best possible results with various qualities of gas. Tables B and C give a calculation of the theoretical amount of oxygen required to effect the complete combustion of two different samples of gas. Attention may be directed to the differences between the first and second columns in Table A. From these it will be seen that a better duty of of about half-a-candle appears to be possible. This is indeed the case; but it is wholly a matter of the regulation of the outer or chimney current of air.

The burner as at present constructed will burn gases of very wide range—up to near about 20 candles. The object sought in determining its construction was to ensure its acceptance by the three London Gas Companies, though the gas they supply differs in quality and composition; and to achieve this result some of its efficiency was sacrificed with certain qualities. A burner constructed in accordance with fig. 2 would have obviated this difficulty; but its use would have been less simple. Another burner has been made to attain this end in another way, though it is more complex and costly to construct. It is shown in fig. 4, and is so constructed that when the flow of gas to the inner and outer edges of the flame is regulated, a portion of the chimney supply is also adjusted.

The "Metropolitan" argand burner described by the authors has been adopted by the Legislature as the standard in many towns of Great Britain, as well as in London. Its use is free from some of the objections raised to the Parisian method when the gas to be examined contains considerable quantities of carburetted water gas, which burns with a much shorter flame in the argand burner than unmixed coal gas, and is therefore over-aërated.

The time does not appear to be ripe in England for the abolition of official testings for illuminating power, despite the rapid increase in the use of Auer burners. The authors venture to express the hope that this fact may be accepted as an apology for introducing to the notice of the International Committee on Photometry a subject which day by day becomes rather of academic interest than of practical value.

Table A.—*Experiments with No. 2 Metropolitan Argand Burner, arranged to be Supplied with Three Measured Streams of Air.*

Illuminating Power in Candles; Gas Consumption 5 Cubic Feet per Hour.		Air Required in Cubic Feet per Hour.			
Air Adjusted by Damper.	Each Air Supply Regulated to Give Best Results.	Inner Surface of Flame.	Outer Surface of Flame.	Chimney.	Total.
13·1	13·2	5·89	6·53	11·68	24·10
13·5	14·0	6·97	6·32	10·08	23·37
15·1	15·4	7·13	6·41	11·07	24·61
15·2	15·6	7·07	5·23	12·29	24 59
16·2	16·6	9·16	7·35	10·58	27·09
17·0	17·6	8·89	6·98	12·84	28·71

Table B.—*Calculated Volume of Air Required for the Combustion of One Volume of Coal Gas having an Illuminating Power of 15·6 Candles at 5 Cubic Feet Rate, with No. 2 Metropolitan Burner.*

	Composition. Per Cent.		Theoretical Quantity of Oxygen Required. Vols.
Hydrogen	48·18	..	24·09
Saturated hydrocarbons	34·18	..	68 38
Unsaturated hydrocarbons	3·05	..	9 15
Carbon dioxide	0·82	..	Nil
Carbon monoxide	4·76	..	2·38
Oxygen	0·61	..	0·61 (deduct)
Nitrogen	8·45	..	Nil
	100·05		103·37

$\frac{1·0337 \times 100}{20·54}$ = volumes of air required for the complete combustion of one volume of gas, or 25·15 volumes per 5 cubic feet of gas.

Table C.—*Calculated Volume of Air Required for the Combustion of One Volume of Coal Gas having an Illuminating Power of 17 Candles at 5 Cubic Feet Rate, with No. 2 Metropolitan Burner.*

	Composition. Per Cent.		Theoretical Quantity of Oxygen Required. Vols.
Hydrogen	47·88	..	23·94
Saturated hydrocarbons	32·62	..	65·24
Unsaturated hydrocarbons	3·45	..	10·35
Benzine vapour	1·27	..	9·53
Carbon dioxide	1·53	..	Nil
Carbon monoxide	6·14	..	3·07
Oxygen	0·20	..	0·20 (deduct)
Nitrogen	6·91	..	Nil
	100·00	..	111·93

$\frac{1·1193 \times 100}{20·54}$ = volumes of air required for the complete combustion of one volume of gas, or 27·25 volumes per 5 cubic feet of gas.

METHODS FOR MEASURING THE LIGHT OF INCANDESCENT BURNERS IN HOLLAND.

By Heer Van Rossum du Chattel.

[A Paper, read by M. Vautier, before the International Photometric Committee last Thursday.]

The author regretted that his efforts to collect the rules generally followed in Holland for determining the illuminating power of incandescent burners had been almost fruitless. From the few particulars available, he was able to report that generally the German method was followed in Holland—viz., the prescriptions made by the Photometric Committee of the German Association of Gas and Water Engineers in 1904. Nevertheless, there were just a few differences, of little real importance, which might be pointed out.

As a standard of light, the Harcourt pentane lamp was used at Amsterdam. The Hefner lamp was never employed directly in the photometry of incandescent burners. It was only used to determine the illuminating power of a gas-light standard of 15 to 20 candle power, of which the illuminating power was kept constant by supplying the gas standard throughout the test with gas of constant composition from a holder. The holder was provided with a rotatory blade agitator, which insured uniformity of composition of the gas. The Amsterdam works possess a great number of photometers, comprising four with the Dutch etherbenzene standard, five Letheby photometers with various Methven standards, five Flicker photometers, and two Harcourt pentane

* It is unnecessary to reproduce the illustrations, as they are the same as those which were given in the "Journal" in connection with the paper which Mr. Carpenter read before the Institution of Gas Engineers last year—see Vol. XCIV., pp. 887-8.

lamps and two Hefner lamps. Consequently they are in a position to make a great number of tests of incandescent burners.

The illuminating power of a mixture of coal gas and water gas is determined by burning it in the English standard burner, as certified by the Board of Trade. The quantity of air admitted is exactly regulated by the damper, which turns on a very fine screw thread. This burner has been adopted by the Dutch Photometric Committee. These burners are made exactly to dimensions, and so that they may be turned about their vertical axes to any point on a disc graduated in degrees. The new photometers used are made by Messrs. Simmance and Abady, with a distance of 2 metres between the sources of light. They are graduated round iron bars, on which are mounted the Flicker apparatus, either for horizontal or angular readings as may be required. For the photometry of high-power or high-pressure incandescent gas-burners, intermediate incandescent mantle standards, of which the illuminating power has been determined with great precision, are used for the direct comparisons. Care is taken to light the burners sufficiently long before making a test, and generally the conditions set out in the German testing prescription (*vide supra*) are observed in the minutest particular, and mantles of faulty shape are rejected.

The Amsterdam works are in a favourable position in that they impregnate, fix, and collodionize their own mantles, using foundations obtained from different countries. They employ a dozen women on this work, and turn out somewhere about 1000 mantles a day. The "Auer No. 1" burner, with regulator for the air supply, is employed for the mantle tests. The gas used is of constant composition, and of which the illuminating power has been previously determined by means of the Harcourt standard; and the burner is regulated until the maximum illuminating power is being developed by the mantle. The mantle is kept in incandescence for 1000 hours, and tests are made at the start and at 50, 100, 300, and 1000 hours. The capacity of the gasholder in not sufficiently great to admit of the whole of the tests on one mantle being made with one charge of gas; it is re-filled, and the new charge brought to the same illuminating power by carburetting with benzol. The burners tested at Amsterdam included the Somzée-Greyson, the Sugg, Keith, Kern, Millennium, and Goldberg's modification of the burner of Messrs. Schülke, Brandholt, and Co. These burners were of very different sizes up to illuminating powers of upwards of 2000 candles.

At the Rotterdam Gas-Works, Dr. Leonard Weber's photometer is in use. With this, the distance from the axis of the mantle to the (No. 3) opal glass screen is one metre. The light used as the standard in the tests is a benzoline flame, 2 centimetres in height. The illuminating power of this flame and the constant for opal glass were determined twenty or thirty times at different distances, by reference to the Hefner lamp. In this manner of working, no trouble was found from differences of colour.

The method of using red and green glass has only been employed for the sake of comparison, and generally gives rather high results. An ordinary Welsbach burner, of which the air supply can be regulated, is used in the tests. The mantle burner is supplied with coal gas exclusively, and is arranged so that it is giving the maximum illuminating effect under a constant pressure of 40 mm. The quantity of gas burnt is varied considerably—viz., from 90 to 150 litres (3·18 to 5·30 cubic feet) per hour. The Hefners are afterwards reduced to English sperm candle values; and correction is made for variations of temperature and pressure. The chimney used is 25 cm. (9·8 inches) long, and 4·5 cm. (1¾ inches) in internal diameter, as is generally used by consumers. Three observations are made in series; the mantles being turned round one-third of a circle between each.

North British Association of Gas Managers.—The forty-sixth annual general meeting of the Association will be held in the Philosophical Society's Hall, Bath Street, Glasgow, next Thursday, under the presidency of Mr. Lawrence Hislop, of Uddingston. We learn from the programme issued by the Secretary (Mr. R. S. Carlow, of Perth) that, in addition to the Inaugural Address, there will be three papers. Mr. Alex. Yuill, of Dundee, will contribute some notes on the "Practical Working of Gas-Works;" Mr. J. D. Smith, of Stirling, will deal with the subject of "Naphthalene Extraction;" and Mr. James Campbell, of Polmont, will take up the question of "Introducing a Supply of Gas into a New District." In the evening the members will dine together in the Grand Hotel; and next day they will have an excursion to Campbeltown, *viâ* Wemyss Bay.

The Retirement of Professor Lunge.—In connection with the retirement of Professor G. Lunge from the Chair of Technical Chemistry at Zurich, to which reference was made in the "JOURNAL" last week, we learn from "Nature" that an interesting farewell meeting was held on the 10th inst., at the Zurich Polytechnic. The occasion was the distinguished Chemist's last lecture hour, and, in addition to the students, most of his fellow professors and some from the neighbouring University had assembled. On Professor Lunge's entry into his lecture theatre all rose in silence. After a brief interval, Professor Treadwell, Professor of Analytical Chemistry, made a short speech in which he eulogized Professor Lunge's work, and afterwards read an address from the whole of the teaching staff. An address from the students was also read. Professor Lunge made a suitable reply; and the audience showed by its enthusiasm the high regard in which he is held and the regret felt at his retirement.

SULPHATE OF AMMONIA AS A MANURE.

In another part of the "JOURNAL" will be found the report of the Sulphate of Ammonia Committee. In the course of a report by Mr. John Hunter, F.I.C., F.C.S., the Technical Adviser to the Committee, on experiments that have recently been carried out by him, further evidence is afforded of the value of sulphate of ammonia in agriculture.

Mr. Hunter states that from every experimental station at home and abroad (with one notable exception) there had come a repetition of field and plot results which all go to prove that organic nitrogen from Peruvian guano or sulphate of ammonia is invariably superior to inorganic nitrogen in nitrate of soda, nitrate of lime, or nitrate of potash; and that where these sources of organic nitrogen have been tested against each other, sulphate of ammonia has proved itself the most reliable and the most economical. The "notable exception" referred to is an English Agricultural College where nitrate of soda is practically the only purely nitrogenous manure employed; but Mr. Hunter says this limited line of investigation (fortunately for agriculture) does not appear to recommend itself to other experimentalists.

The Agricultural Executive Committee of the Lancashire County Council report the best results in the potato trials from 10 tons of farmyard manure, 4 cwt. of superphosphate, 1½ cwt. of sulphate of potash, and a like weight of sulphate of ammonia per acre. The Irish Department of Agriculture, as the result of experiments in County Carlow, again recommend superphosphate, sulphate of ammonia, and potash salts. The Board of Agriculture (London) recommend the following as the best potato manure: 10 tons of farmyard manure, 2 cwt. of superphosphate, and 1 cwt. each of sulphate of potash and sulphate of ammonia per acre; and that where farmyard manure is not available, the best mixture to use is 4 cwt. of superphosphate, 2 cwt. of sulphate of potash, and 2 cwt. of sulphate of ammonia. Similar recommendations are made by the Cambridge University experts and by the Agricultural Research Association; and they are corroborated by reports from all quarters.

Concerning the feeding experiments, Mr. Hunter says it is again proved beyond all doubt that crops grown by organic nitrogen (by ammonia salts) possess the best feeding properties, as illustrated by the prize winners at the Smithfield and Scottish National Shows; and the Committee's own experiments, conducted in nearly every district in England, Scotland, and Ireland, again provide interestingly valuable evidence as to the importance of organic nitrogen, in the numerous examples of applying a general mixture. But where comparing-plots without sulphate of ammonia have been grown alongside, its great value is made manifest by the handsome increase of crops obtained by including sulphate of ammonia in the mixture.

The experiments on yellow turnips are confined to Scotland; but the smallest crop is more than 31 tons per acre, while the majority of the crops are conspicuously higher, and reached the magnificent return of nearly 52 tons per acre. The greater number of the crops in the swedes class range from 30 to more than 48 tons per acre; but even in the case of the smallest crops, the profitableness of including sulphate of ammonia in turnip manures is put beyond all doubt. With the exception of one small crop of mangels in the Thame district, the crops range from upwards of 30 tons up to nearly 69½ tons per acre; while the majority are over 50 tons. The largest crop—69 tons 7 cwt.—was grown with a good general manure containing 2½ cwt. of sulphate of ammonia. On the adjoining plot, where sulphate was excluded, but the manuring was the same in every other respect, the return fell to 51 tons 12 cwt.—a difference of nearly 18 tons per acre. Mr. Hunter states that in all the other similar examples in this class, the addition of organic nitrogen in the form of sulphate of ammonia has proved highly profitable and confirms most absolutely the many earlier records of the marked advantage of sulphate in mangel culture.

The smallest crop in potatoes is 12 tons 1 qr. per acre. There are seven crops of about 13 tons per acre; but all the others are from 14 tons up to 18 tons 3 cwt. In this class also the advantage of sulphate is very conspicuous; and Mr. Hunter says it is now a well-ascertained fact that nitrates invariably give rise to waxy tubers whose value is, of course, much less than that of "good cookers."

The range of crop in the class of field cabbage is from 64 tons 1 cwt. to 74 tons 16 cwt. 2 qrs. 12 lbs. per acre. Mr. Hunter regards it as surprising that farmers do not grow more cabbage, as on suitable soil a very large weight per acre can be produced. Weight for weight, cabbage is a distinctly richer food than turnips; it forms an excellent change of food and well repays the trouble of planting. Withholding sulphate of ammonia from the manure mixture caused a drop of from 10 tons to nearly 12 tons per acre in the yield.

Mr. Hunter says that it is a remarkable feature that in all the foregoing classes where ground lime has been used, the limed crop is almost invariably the best in every district. This is a question of the utmost importance to every agriculturist; and as the rational application of lime to soils has been very fully explained in the Committee's pamphlets (which farmers can procure free of cost), he considers they will be blind to their own interests if they do not forthwith make full inquiry as to the advantages to be gained by this method of treating soils.

THE ASSOCIATION OF WATER ENGINEERS.

ANNUAL MEETING AT WINDSOR—JUNE, 1907.

PAPERS READ.

(3)

NEW WATER-WORKS AT MILTON-NEXT-SITTINGBOURNE.

A paper on the above subject was submitted by Messrs. WILLIAM GORE and MARTIN DEACON, Assoc.MM.Inst.C.E., from which the following are extracts.

Milton-next-Sittingbourne, or Milton-Royal as it will probably be known in the near future, is situated in the northern portion of the County of Kent, on the south bank of the River Swale, and about 10 miles in an easterly direction from the town of Chatham. Prior to the year 1904, the urban district of Milton obtained its water supply from the works of the neighbouring urban district of Sittingbourne, in return for which Milton contributed a portion of the capital, establishment, maintenance, and other charges. The population of Milton at the census of 1891 was 5213, and in the spring of 1901 it was 7091—showing an increase of 1878 in ten years. The Sittingbourne works having proved inadequate to meet the increasing demands of Milton, Mr. G. F. Deacon, in August, 1901, furnished a report to the Milton Urban District Council, recommending the scheme described in the present paper. It was accordingly decided to apply to the Local Government Board for a loan. In September, 1902, the necessary approval was obtained; and the following works were subsequently carried out.

Pumping Station.—The pumping station is situated upon a triangular piece of ground at the junction of two roads, and the buildings stretch across the bottom of the valley at the base of the triangle facing the apex; the site being surrounded by hop and fruit gardens. The buildings comprise an engine-house, with two well-houses equally spaced on either side, and an attendant's house, which is partly behind and partly to one side of the engine-house, of which it is an extension. Transmission shafts, by which the engines drive the pumps, are placed in culverts above the original ground level, but below terraces (faced with low retaining walls) which link the buildings together. Access to the terraces is obtained by stone steps on either side of the engine-house. The buildings are of red brick, with Bath stone facings except the lower parts, which, with the terrace walls, are faced on the outside with Kentish rag. The roofs are covered with red tiles. Ornamental entrance gates have been provided, and the grounds have been suitably laid out and planted with shrubs.

Wells and Adits.—Two wells, at a distance apart of 100 feet, were sunk to a depth of 109 feet. The upper 12 feet in each well is 6 feet in diameter, and the remaining 103 feet is 5 feet in diameter. They are lined with brickwork in cement mortar to a depth of 40 feet. The lining at the top of each well is hollowed out to provide room for an air vessel, and extended to carry the overhead gearing and the protective building. For 6 feet, the wells pass through surface soil and gravel; for the remaining depth, through upper chalk with flints. In the western well a borehole 9 inches diameter is sunk to a further depth of 60 feet, wholly in the upper chalk with flints. An adit 5 feet high and 4 feet wide was driven between the two wells, with its invert at 103 feet below the surface in the western well and rising to 101 feet at the eastern well, whence an additional adit is driven at first eastward and then south-eastwards, making a total length of adit of 165 feet.

The sinking of the wells was carried out by hand as follows: Both wells were sunk till water was reached, which was at 61·5 feet from the surface in the western well and 65·5 feet in the eastern well; and as the surface level was the same (135 O.D.) at both wells, there was a difference in the levels of the water of 4 feet—a remarkable circumstance for two wells only 100 feet apart.

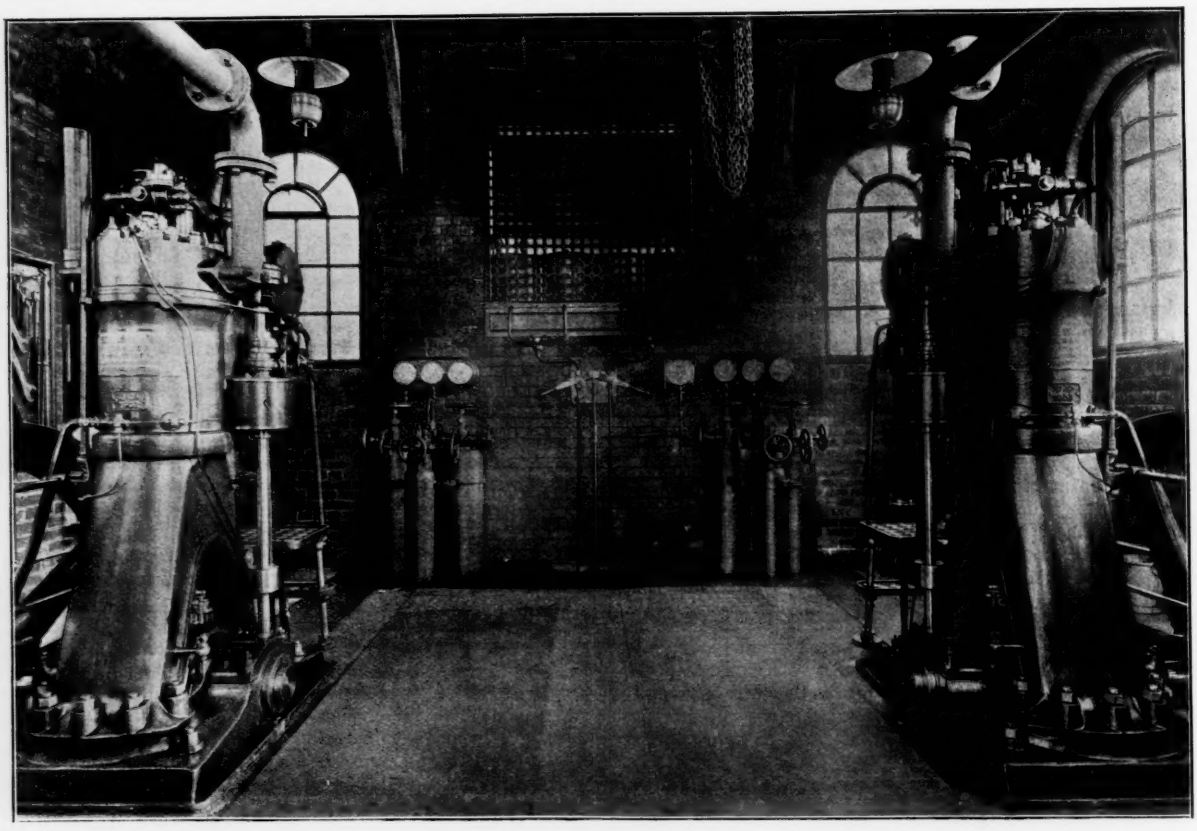
Temporary pumps were next erected in the western well, which was then sunk to a depth of 104 feet, or 1 foot below the level of the adit. The continuous yield of this well amounted to 8000 gallons per hour. The 9-inch borehole was then sunk, and the yield increased to 10,000 gallons per hour. The adit was next driven from the western well towards and under the eastern well, and the yield rose to 18,000 gallons per hour. While this quantity was being pumped out, the level of water in the partially completed eastern well remained practically unaltered, notwithstanding that the adit was driven underneath it. To drain this well a 9-inch borehole was driven down to the adit, and then the well was sunk to a depth of 109 feet; the yield being increased to about 20,000 gallons per hour.

The eastern adit was then driven for about 10 feet, and the yield rose to 21,400 gallons per hour. As the temporary pumps could only with great difficulty keep the water down, the Contractors, with the Engineer's permission, decided to instal the permanent pumps, although the western well had yet to be sunk 5 feet deeper and the adit to be extended further. The work of sinking the remaining 5 feet of the western well was subsequently carried out by divers; and during the completion of the eastern adit the permanent pumps were used—precautions being taken to allow the turbidity of the water to subside before it reached the pumps. The yield of the well had now increased to 24,000 gallons per hour.

At the present time one set of engines and pumps, pumping at the rate of about 16,000 gallons per hour for eight hours, lowers the water from 64 to 84 feet below the surface. The water returns to its original level in the course of a few hours after pumping has ceased. The storage capacity of the wells, adits, and surrounding chalk admits of both sets of engines and pumps being run continuously for about 5 hours before the water is drawn down to the suction openings in the pumps.

Pumps.—Each set of pumps consists of three single-acting "Ashley" pumps, 6½ inches in diameter, with a stroke of 30 inches, and is driven by three-throw cranks forged from one piece, which rotate at 27 revolutions per minute. Each working barrel is attached near the bottom of the well to an independent rising main, 8 inches in diameter, suspended from girders fixed near the surface. The rising main forms a guide to the pump-rods, which are 91 ft. 6 in. long. A short distance above the suspension girders is the stuffing-box, cast in one piece, with the crosshead guides and cover to the working barrel. The bucket of each pump consists of a gun-metal sleeve, 4 feet 10 inches long, which fits the working barrel for a distance of 7½ inches at each end. The central portion of this barrel for a length of 3 feet 7 inches is reduced in diameter and flattened, in horizontal section to an equilateral triangle, to the three vertical planes of which the eighteen suction valves are screwed. The upper end of the sleeve carries the two annular gun-metal delivery valves, which are guided by the pump-rod. The suction valves consist of rubber discs, held by phosphor-bronze springs to gun-metal seats, the rubber discs being guided by stalks fixed to bridges across the suction openings. The centre of the working barrel is pierced with a number of vertical slots, through which the water can pass to the suction valves, and the bottom of the barrel is closed with a screwed plug. Each three-throw crank is driven by double helical gearing of cast steel, with a gear ratio of 8·65 to 1; the pinion being fixed at one end of the transmission shaft from its engine.

Engines.—The engines (see next page) were supplied by the Diesel Engine Company, and are single cylinder vertical internal combustion engines of 20 B.H.P. The diameter of the piston is 9½ inches and the length of stroke 15 inches. The cycle of operations in the engine cylinder is completed in four strokes. The oil fuel, which is desulphurized Texas liquid fuel with a calorific value of about 18,000 B.Th.U., is supplied by a small plunger pump driven by an eccentric upon a vertical shaft which carries the governors, and the amount of oil supplied is regulated by the governor controlling a device, which, by a movable eccentric, lifts the suction valve of the oil-pump for a shorter or longer portion of the delivery stroke, and thereby maintains a uniform speed. The oil is delivered at the pumping-station in 50-gallon steel barrels, and is there discharged into an underground tank which contains 700 gallons. From this tank the oil is pumped by hand into a high-level tank containing 100 gallons, which, together with four oil-filters beneath, is placed in an opening in the engine-house wall. The filtering



Engines at the Milton-next-Sittingbourne Water-Works.

material is a pad of felt ¼ inch thick placed between copper wire gauze. Each engine is provided with a silencer in the form of a cast-iron drum which is placed in a properly ventilated space in the entablature over the front door of the engine house.

Starting the Engines.—The engines (working as compressed air engines) although normally not required to do so, will, with the ease of steam-engines, start the pumps against the full head of the reservoir. An automatic device has been provided for stopping the engines when the reservoir is full; and it does its work very efficiently. A direct-acting balanced float regulator is fixed in the reservoir at the head of the delivery main. The float is placed in a separate cast-iron chamber which has only a small opening into the reservoir to ensure perfectly steady motion of the float. When pumping is in progress, and the water in the reservoir has run to within an inch of its top-water level, the regulator commences to close, and gradually increases the pressure in the delivery main until the relief-valve in the pumping-station opens automatically. Underneath the discharge-pipe of the relief-valve a copper bucket is suspended at the opposite end of a counterbalanced lever. When the bucket fills, it raises the counterbalance, and in so doing closes the oil-cocks upon the pipes supplying fuel to the engines, which stop in about one minute. The water in the bucket then runs out at a small hole, and the bucket returns to its original position for the next automatic stop. The float regulator is set with a minimum opening sufficient to create a maximum back-pressure of about 50 feet in the rising main when both engines are running, if the bucket is forcibly prevented from falling, This apparatus prevents the water from being run to waste at the reservoir unknown to the attendant, and allows him to be absent from the pumping-station for short intervals. The present practice is to run a set of engines and pumps every day until it stops automatically; one set being used one day, the other the next.

Service Reservoir.—The service reservoir at Stocker's Hill is circular in plan and 79 feet in diameter. It is 18 feet deep, and, when full to within 18 inches of the top of the coping, contains 550,000 gallons. Its top-water level is 208·75 feet O.D., or 177 feet above the suction openings of the pumps, and 184 feet above the general level of the ground at the point of supply about two miles distant. The reservoir is partly excavated and partly embanked in a homogeneous loam resting upon chalk. The floor is of 5 to 1 concrete 15 inches thick. It is divided into nine sections, which are separated from each other and from the wall by tapered grooves, 6 inches deep, filled in with asphalte. Large areas of concrete subject to variations of temperature inevitably crack; and the object of the grooves is to induce the cracking to take place along them and thereby relieve the tendency to crack at other places. The asphalte in the grooves acts as a viscous fluid under the pressure of the water, and seals any crack that may occur.

The walls are in the form of a vertical cylinder of 5 to 1 concrete 3 feet thick, faced with brindled brickwork, and surmounted with a concrete coping; the latter being moulded *in situ* in lengths of about 6 feet, separated from each other by thin strips of wood, which were afterwards cut out and the space caulked with cement mortar. A circular reservoir is much more economically constructed than one with straight sides, as the walls are less both in their length and thickness.

The experiment was first made of leaving the reservoir open to the air; but after being in use during the first summer months the usual green confervoid growth resulting from the open storage of most chalk waters appeared, and it was decided to cover it. The covering consists of arcades of concrete segments or tiles, 2 inches thick, 30 inches long, and 30 inches wide, struck to a radius of 50 inches, which rest upon the lower flanges of steel joists, 4¾ in. by 1¾ in., carried by main joists, 12 in. by 6 in., resting upon ten cast-iron columns and upon recesses in the circular coping of the reservoir. With the exception of the ends of the main joists upon the cast-iron columns and some special work at the valve platform, no fastening designed to act in tension was used in the construction of the framework.

The concrete segments were moulded on edge in collapsible boxes. Each box contained 10 segments separated from each other by greased sheet-iron partitions. The segments, protected by wet bags, were allowed to set for about three days. The boxes were then carefully taken apart, the sheet-iron partitions were withdrawn, and the concrete was allowed to harden for a month, or until such time as the segments were required. The proportions of the concrete were 5 to 1, and the limit to the size of the gravel used was ½ inch. After the segments had been placed in position, the irregular spaces between them and the circular wall were filled with concrete, and the joints between consecutive segments and at the ironwork were caulked with cement mortar.

Except for a short period when preparing the bases, and

during the erection of the cast-iron columns, the work of putting on the cover was carried on while the reservoir was in use for the supply of water to Milton. As a permanent work, such a covering is not, of course, so satisfactory as a groined roof—covered with earth and grassed over—supported by brickwork or concrete piers; but it is quite effective, and the more permanent work could not have been adopted without throwing the reservoir out of use.

Cost of Works.—The total cost of the works was about £13,400.

Cost of Pumping.—The price of the crude Texas oil is 50s. per ton at the Company's depôt, Thames Haven. The total amount paid for crude Texas oil last year was £32, for paraffin £12 15s., and for lubricating and other oils £9 10s.—making a total of £54 5s. The total cost of lifting the water 164 feet (including friction) into the reservoirs, including oils, tradesmen's bills, and wages at the pumping-station, works out at 0·79d. per 1000 gallons, equivalent to 4·8d. per million gallons raised one foot high, of which the labour represents 3·1d. For a scheme with engines of only 20 B.H.P., this is a remarkably high duty, and fully establishes the high economy claimed for the Diesel oil-engine. Some 48 million gallons of water were pumped from the wells last year in 3000 hours, or at an average of 8 hrs. 13 min. per day, to supply an estimated population of 8000, which, including trade supplies, amounts to 16½ gallons per head per day.

Discussion.

The PRESIDENT (Mr. C. Sainty) said they had to thank Messrs. Gore and Deacon for their paper. The Diesel oil-engine, so far as he could see, was an economical one; and it was a cheap way of getting water.

Mr. J. H. SECKER (Slough), invited by the President to speak, said that at the Slough Water-Works he had a small Diesel engine of 10-horse power, with three-throw pumps, pumping 5400 gallons an hour, against 150 feet. The plant was not used every day, as it was for an extension made for the Slough Water-Works about three years ago for a high-level district, where they pumped from the main reservoir at Stoke up to Stoke Common, which was 150 feet high. With regard to the economy of the engine, he agreed with Mr. Sainty that it was an economical engine. His fuel consumption at the present time, pumping 5400 gallons an hour, was 0·34 of a gallon of paraffin, the cost of which in his case worked out at 6½d. per gallon. At the present time he was experimenting with a bye-product, which he was obtaining from the Diesel Engine Company; and this worked out to 3½d. So that this would practically reduce his money expense to one-half.

Mr. R. ASKWITH (Weardale Water-Works Company, Bishop Auckland) asked whether in connection with this engine there had been any liability to pre-ignition. Pre-ignition in an internal combustion engine was a serious matter, because the blow came upon the crank before the crank was in a proper position to receive it. He was informed that pre-ignition was overcome in gas-engines by squirting water into the cylinder. He should like to know whether it was possible to do the same thing in an oil-engine.

Mr. JAMES DEWHIRST (Chelmsford) remarked that he had not a Diesel oil-engine in use; but he had several of the ordinary type of oil-engines, varying from 5 up to 25 horse power. On one of them he had tried a crude oil for feeding the engine for power purposes, and a refined product for heating the lamps for ignition. The experiment was not to his mind satisfactory, because the crude oil contained some impurities, necessitating frequent cleaning of the vaporizer, combustion chamber, &c. He had recently put down a gas-engine of 20 B.H.P., with suction-gas plant, which was working very well indeed. It had, however, only recently been set to work; and he had not yet been able to carry out a series of tests as to fuel consumption and cost of pumping. But compared with an oil-engine of similar power, and doing very similar work at another pumping-station, the cost of fuel for the last three months was, for the gas plant, nearly one-half the cost of fuel for the oil-engine. His own experience with oil-engines was such that he should hesitate to use a Diesel oil-engine. He could purchase petroleum at prices varying from as low as 3¼d. per gallon to 6d., but the costs worked out very low. Regarding the paper, he thought if the authors had a breakdown with the left-hand engine and the right-hand pump or *vice versâ*, they would be in an awkward position. In his own case he could run either pump or engine in any way he liked.

Mr. N. M'K. BARRON (Lincoln) remarked that the authors stated that the reservoir was partly excavated and partly embanked in a homogeneous loam resting upon chalk. He should like to know the respective depths of the loam and the chalk, and the angle of repose of the excavated material. Further, it would be interesting to learn the thickness of the brickwork facing. Also whether the concrete floor had been rendered. If not, had the reservoir proved water-tight?

Mr. J. S. PICKERING (Cheltenham) asked why two wells were sunk, instead of one, as the same quantity of water could have been obtained from one well; and there was a certain loss of power transmitting this through shafting.

Mr. WILLIAM MATTHEWS (Southampton) said he was going to ask the same question, as to why the authors adopted two wells necessitating the use of long transmission shafting. Then a question arose out of the statement of the authors that precautions were taken to allow the turbidity of the water to subside before it reached the pumps. He (Mr. Matthews) should very much like to know how this was done. With regard to the machinery, he could not say he was much taken with the arrangement of putting three long suction barrels down in the way described, and, every time there was anything to be done, having to pull everything up, including all the long rods, and dispose of them at the top of the well. Three sets to one pumping plant of this rather limited capacity! It was surely adopting an arrangement which was giving a great deal of trouble in working. He should also like to know whether the floating automatic arrangement for stopping and starting the engine was satisfactory, and whether the starting of the engine by compressed air acted well in practice. The question of pre-ignition was an interesting one to him, because he had recently been looking at a pumping set and an engine of the Hornsby type, in which the conditions internally appeared to be so unsatisfactory that the engine could only be run for about five hours without having to remove the cover and clear out the vaporizer. This was not a condition of things that he should consider a very happy one. With regard to the covering of the reservoir, why was the plan described adopted, instead of using concrete, allowing it to set *in situ* upon framing or centering, as was frequently done. The total cost of pumping given at the end of the paper was certainly one upon which those responsible for the design of the works had every reason to congratulate themselves. It was really very low.

The PRESIDENT remarked that when he saw these pumping costs, he also thought the authors were to be highly complimented.

Mr. GORE, in replying to the discussion, said the figures given of the cost of pumping were the actual working costs as abstracted from the books last year, supplied to him by the Surveyor of Milton, who had charge of the works. The paraffin oil included that necessary for illumination, heating, and general purposes at the pumping-station. He had not heard of pre-ignition in connection with this particular plant, nor, in fact, in any other Diesel engine plant. In reply to Mr. Dewhirst's question as to the left-hand engine and the right-hand pump breaking down simultaneously, there were three pumps in each well; and the risk of all three breaking down simultaneously was very remote. If one broke down the other two could be worked without it. They had six times the necessary power at the present time, and that was a very good safeguard against breakdown. The two wells enabled two independent sets of pumps to be put in, so that work could be carried on in one well without interfering with the pumping at the other. The rods and the pump buckets had been lifted once since the plant was started. This was done quite easily without pumping. There was something like 50 feet of water in the well, which could not be lowered to get at the pumps in the ordinary way. With the rising main in the wells suspended at an easily accessible place, it and the pumps and their valves could be easily drawn to the surface. The thickness of the brickwork of the reservoir was 9 inches for three courses out of every four; and the fourth course was 13½ inches. At the back of the brickwork was a ring of mortar ½ inch thick. The reservoir was sunk about 11 feet in the ground and embanked the remaining 8 ft. 3 in. He believed the natural angle of repose of the excavated material was considerably over 50°. With regard to the float regulator in the reservoir for stopping the engines, it worked perfectly. The attendant filled the reservoir every day. He simply started the engines, and let them run until they were stopped by the automatic appliances; and there had been no trouble since it had

been put into working order. One of the reasons, as stated in the paper, for adopting the particular type of covering for the reservoir was to keep it in use for the supply of the town during construction. If ordinary concrete had been put in, it would have been much thicker than the present 2 inches, requiring a heavier and more expensive steel framework to support it. The reservoir was found by careful gaugings to be absolutely water-tight. The turbidity of the water during the driving of the eastern adit was removed by collecting the springs and passing the water direct to the pumps and by settling the remainder. Most of the pumping was carried on at the well farthest from the position at which the adit was driven. The difference in level at the end was 3 ft. 6 in., and successive tanks were put in so that the turbid water escaped first from one to the next, and there was considerable settling capacity for the small amount of turbid water.

Mr. MATTHEWS: Then you had a good big fall.

Mr. GORE: Yes. There was 2 feet in the main adit; and in the adit being driven, it was 1 ft. 6 in.

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SCUNTHORPE WATER-WORKS.

The last paper was a description of the Scunthorpe Water-Works; the author being Mr. Alexander M. Cobban, the Water Engineer of the Urban District Council.

Owing to the development of the large deposits of iron ore upon which the township of Scunthorpe is situated, and the establishment of several iron-works, as well as the large steel-works of the Frodingham Iron and Steel Company, Limited, the township has grown from a village to the position of the second most important township in North Lincolnshire. In 1871 the population was 616, whereas the population of Scunthorpe, without the neighbouring townships of Crosby, Frodingham, and Ashby, now exceeds 9000, and the number of houses has increased from 877 in 1895 to 1600 in 1905. The area of the Urban District is 1041 acres; and the rateable value is £29,925. The town, however, is a compact one, well laid out, and occupies some 110 acres. While the part to the east is occupied by iron-stone mines and iron-works, that lying west is agricultural land extending to the River Trent.

Previous to the carrying out of the works described in the paper, the water supply was derived from shallow wells sunk through the subsoil, with a sump formed in the iron-stone—a source particularly liable to contamination. But even this supply, bad as it was, failed through the quarrying of the ironstone at the lower end of the district, which caused the lowering of the level of the water. Nevertheless, the failure of this source of supply cannot be looked upon as altogether a calamity, as it emphasized the necessity for the provision of a reliable potable supply, free from contamination.

In 1895, the Urban District Council consulted specialists, and, upon the advice given, adopted a scheme for obtaining a new supply from the new red sandstone, and powers to borrow the necessary capital for the works were obtained from the Local Government Board. A deep bore was put down by Vivian's Boring and Exploration Company, Limited, of Whitehaven; the author being the Engineer-in-Charge. This was commenced 21 inches diameter, and finished, after many difficulties, 8¼ inches diameter at a depth of 1767 feet. All marl waters and those from the upper sandstones were excluded by means of screwed lining tubes carried to a depth of 1567 feet. Final pumping tests proved the existence of an abundant supply; but, on analysis, the water, which was entirely free from organic impurities, revealed the presence of mineral impurities in excessive quantities—viz., a total of 388·5 grains per gallon, including 146 grains of calcium sulphate, 31 grains of calcium chloride, 53 grains of magnesium chloride, and 31 grains of sodium chloride. No doubt, these were due to the presence of saliferous beds in the lower sandstones. During the later stages the advice of Professor Boyd Dawkins was sought, and every endeavour made to secure satisfactory results, but without avail.

While the work of boring was proceeding, the Urban District Council obtained (in 1899) an Act of Parliament for gas-works purposes; and the necessary powers in regard to water supply were added thereto. When it was proved beyond question that the nature of the water from the deep bore precluded its use as a supply for the town, the author was instructed to draw up a scheme for taking water from the Oolites with the Risby Warren as a gathering-ground. Parliamentary powers for this were obtained by the Scunthorpe Water Act, 1903. The Warren is a natural basin falling east, totally uncultivated, entirely devoid of habitation, and hence totally free from manurial or drainage contamination, and by reason of the nature of the soil not eligible for either agricultural or building purposes.

The Scheme.—The water is pumped from an underground tank by means of electrically-driven pumps, which are in duplicate, through 2 miles of 9 inches diameter pumping main, against a maximum head of 240 feet (including friction), to a storage reservoir of 750,000 gallons capacity situated at an altitude of 226 feet. The highest point in the town is 132 feet above Ordnance datum. From the reservoir the water gravitates to the town some two miles away. The power station where the electrical energy is generated is situated at the Council's gas-works, 4¾ miles distant from the pumping station; the energy being conveyed by means of armoured cables laid underground.

Pumping Station.—The pumping-station occupies an area of 2 acres. The subsoil for a depth of 3 feet was sand, followed by 10 feet of heavily watered gravel and 22 feet of limestone also charged with much water. Here an intercepting underground tank, 150 feet long by 22 feet deep and 10 feet wide, was formed near the foot of the fault and at the extreme eastern end of the gathering-ground. The sides and ends were walled to a depth of 10 feet with 18-inch brickwork resting on the limestone, the sides being stiffened by arches at 22 feet centres upon which a roof of ferro-concrete was constructed. A 6-inch trial bore put down in the bed of this tank gave a water level in the tank 4 ft. 7 in. above the level of the stream, which was some 20 feet away. The foundations for the engine-beds are carried down to the rock 10 feet below ground line, and the basement is excavated to form a pipe subway and store.

The machinery comprises one set of horizontal three-throw pumps, belt-driven from a 50 H.P. "A.C." motor. The pump, which was made by Messrs. Frank Pearn and Co., has interchangeable barrels and slipper guides to the cross-heads, and is capable of pumping 25,000 gallons per hour against a total head of 240 feet (including friction). The rams are 10 inches diameter by 12 inches stroke, of cast iron cased with gun-metal, working through gun-metal rings, and gun-metal bushed glands. Valves and seatings are of gun-metal, cranks of forged steel working in gun-metal adjustable bearings, connecting-rods of best hammered iron, fitted with gun-metal adjustable bearings at each end, and first motion shaft of steel working in gun-metal bearings. The efficiency of the pump was guaranteed by the makers to be from 85 per cent. to 92 per cent. of the theoretical capacity. The motor is a 50 H.P. 2200 volt three-phase 25 cycle "A.C." short-circuited type induction motor, running at 480 r.p.m. The efficiency guaranteed is as follows: Full load, 88 per cent.; half load, 87 per cent. Power factor, full load, 90 per cent.; half load, 78 per cent.

A duplicate pumping plant is provided, consisting of a multi-stage high-lift turbine pump of the same capacity as the three-throw set, having three stages, and running at 1440 r.p.m. The pump is driven by a 50 H.P. "A.C." motor through flexible couplings, the pump and motor being fixed on the same bed-plate. The pumps have cast-iron casings, the impellers and guide passages being made of special phosphor-bronze. The shaft is made of nickel steel running in ring-oiled bearings. This pump was made by the Worthington Pump Company, Limited.

A telephone installation is provided, giving communication between the reservoir, the engineer's office, and the power station respectively.

Storage Reservoir.—This is situated on a site having an area of one acre; and it has a capacity of 750,000 gallons. It is built half above and half below the natural ground level, and the whole of the aggregate required for the concrete walls was supplied from the excavated limestone; the remaining spoil being used to form the bank. The reservoir is 150 feet long, 80 feet wide, and 12 feet deep (inside dimensions); the walls being battered on the inner side from 3 feet thick at the base to 2 feet thick at the top, and made of 1 to 5 concrete. The floor is 12 inches thick, of concrete resting on the solid rock. The reservoir is divided into two equal parts by a division wall 5 feet high. The roof is formed of armoured concrete 6 inches thick, supported on cast-iron columns, anchored to bed-plates, with 8 in. by 5 in. R.S. girders between them. There are four

rows of columns, dividing the roof into five bays, placed at 12 feet centres. Cross girders 6 in. by 4 in. are placed across the bays between the 8 in. by 5 in. girders, forming bays 12 ft. by 15 ft. in the clear. The roof was laid upon stout centring covered with oiled paper, and was armoured with expanded steel, having a 3-in. mesh and $\frac{3}{16}$ in. by $\frac{1}{4}$ in. section. The walls are capped with special channel coping 18 inches wide, of Victoria stone, overhanging the outer face of the walls 6 inches, in order that the roof water cannot percolate between the walls and the bank. The roof water is conducted from these channels down the face of the bank to surface water drains. Inlet, outlet, and washout valves are placed in pits in the footways at the base of the bank. The inside faces of the reservoir walls and the outer face of the roof are rendered with cement. All the ironwork is painted with graphite paint. The base of the bank is finished with a combined kerb and channel surrounded by a footway of red gravel.

The outlet-pipe is provided with a Venturi meter; the recorder being fixed in the office near the entrance gates. A self-recording rain-gauge is fixed on the top of the reservoir; and a self-recording barograph and thermometer are also provided, so that meteorological observations can be kept. The office is furnished with a telephone, and has a tool-house adjoining. An electrical water-level recorder is arranged so that the depth of water is registered in the engine-house at the generator station.

It will be seen that the design of the reservoir combines lightness with strength, very small water capacity is taken up by the piers, and no expense is incurred in brick arching. The sites of both the reservoir and the pumping-station are surrounded by a steel paled fence 7 feet high, with standards bedded in concrete and brick pillars.

Distribution.—The gravitation main conveying the water from the reservoir to the town is 2800 yards long and 8 inches diameter. The distributing mains in the town comprise 1114 yards of 8-inch, 276 yards of 7-inch, 642 yards of 6-inch, 6420 yards of 4-inch, and 1940 yards of 3-inch pipes, which are all spigot-and-socket pipes and coated. The pipes were supplied by the Sheepbridge Coal and Iron Company; the valves, by Glenfield and Kennedy, Limited.

Power Station.—The generating station is situated at the Council's gas-works, and comprises boiler-house, dynamo, and engine-room. There are two Lancashire boilers, each 30 feet long by 8 ft. 6 in. diameter, supplying steam at 80 lbs. per square inch to two sets of engines and generators, working either singly or together as required. Each of these sets includes a compound high-speed engine with cylinders 11 inch and 15 inch diameter respectively, and 7-inch stroke, made by Allen, of Bedford, giving a B.H.P. of 100 at a speed of 500 revolutions per minute. The makers guaranteed a steam consumption not exceeding 28 lbs. per B.H.P. per hour working non-condensing, also a mechanical efficiency of 91 per cent.

Each generator is coupled direct to its engine, and fixed on the same bed-plate, and is of the alternating current type, 2200 volts, three-phase, 25 period, 6 poles; speed, 500 r.p.m. The capacity of each generator is 17 amperes per terminal at 2200 volts and 100 per cent. power factor. The normal rated output is 65 kilowatts. Each generator is separately excited, and the field winding is so proportioned that, with constant speed, constant separate excitation, and 100 per cent. power factor, the load may be varied from full load to no load without a greater rise of voltage than 12 per cent. The efficiency of each generator at normal rated current and voltage and at 100 per cent. power factor is guaranteed at not less than 80 per cent. at quarter load, 87·5 per cent. at half load, 90·5 per cent. at three-quarters load, and 91·8 per cent. at full load.

The switchboard is in four panels, of white Sicilian marble 2 inches thick, with $\frac{1}{4}$ inch chamfer, highly polished, each panel being supported in a rigid iron framework, and supported by channel-irons. The switchboard is furnished with all the necessary switches, fuses, voltmeter equipment, ammeters, and lamps, and is adapted for future extensions. The generating plant is designed so that either set can be run through a motor-generator set, taking current at 2200 volts, and giving out current at 330 volts for charging storage batteries for lighting, or supplying light direct, and foundations are provided for a further 350 kilowatt set for lighting if needed.

Cable.—The cable from the power station to the pump-house, $4\frac{3}{4}$ miles away, is suitable for a working pressure of 2200 volts, having three conductors, each conductor being insulated with impregnated paper. These three cores are wormed together, made up circular with packing, and further served with impregnated paper. They are then sheathed with lead, yarned and armoured with two stout tapes of steel, and finally yarned and compounded over all. Each conductor has an area of 0·022 square inch.

General Features.—The inaccessibility of the pumping-station for carting fuel, &c., rendered the adoption of electrical energy a *sine quâ non*. The question of adopting power gas, oil, or steam motive power was fully considered; but the peculiar nature of the undertaking decided the author in favour of electricity. The special and unique features of the scheme are the distance of the pumps from the power-station, the adoption of high voltage three-phase current, the use of armoured cables laid direct in the natural soil, the adaptability of the pumping plant for use for electric light, and of the electric light plant to serve as a duplicate pumping plant.

Efficiency of Plant.—After the plant had been running for over four months, tests were made with the generators and three-throw pumps. Though the pumps were guaranteed for a lift of 240 feet, the actual head was only 160 feet, and at 40 revolutions (400 gallons) per minute, the theoretical horse-power required equals 19·4. The actual electrical energy, however, was $4\frac{1}{2}$ amperes; and with a tested load on the outers the ampere-volts equalled 16,560, equivalent to 22·2 H.P.—showing a mechanical efficiency of 87·4 per cent.

Cost.—The estimated cost of the works was £16,960, and the actual cost was £17,213; the cost of the reservoir worked out at £2 13s. per 1000 gallons capacity.

Discussion.

The PRESIDENT said he could not understand how it was possible for Mr. Cobban to lay the 8-inch main in the town at so low a price. It was more than they could do in the roads in Windsor to get the pipes down to a depth of 3 feet at only 1s. 10d. a yard; it would cost them at least 3s. per yard. The work was rather hard for the men if the roads were as solid as they were in Windsor. However, he congratulated the author on the figure for which he had done the work.

Mr. W. G. PEIRCE (Richmond) asked the author to give the members the rate of wages paid to the ground men and jointers. The cost of the work seemed very low indeed.

Mr. T. MOLYNEUX (Stockport) remarked that, in the portion of the paper dealing with the storage reservoir, he noticed that the aggregate required for the concrete walls was supplied from the excavated limestone. He should like to know whether the author had had occasion to examine these walls since he used the limestone, and whether he had found any wastage. He (Mr. Molyneux) would also be pleased if Mr. Cobban would give them the cost of pumping per 1000 gallons.

Mr. W. R. LOCKE (Hemel Hempstead) asked what quantity of water the author received from his 6-inch borehole per hour, and also the proportion (if any) that he obtained from his weep-holes. The author had provided an overflow into the tank; and he (Mr. Locke) would be pleased to learn if he had found any variation, and, if so, how soon after a fall of rain.

Mr. J. H. SECKER (Slough) said he noticed the reservoir loop was built of wrought-iron girders and concrete, and was not covered with earth. He should like to know if there was any arrangement made to compensate the expansion and contraction of the roof due to the heat of the sun in summer.

Mr. W. GORE (London) thought that the most interesting feature about the paper was summed up in the paragraph in which the author referred to the electrical transmission scheme. He had had, on the one hand, experience of three-phase transmission schemes, and on the other of pumping plants for water-works, but none of the combination. The cost of the energy was not everything, because the interest on capital and the maintenance in most water-works schemes quite swamped everything else. Then in most schemes of this size, the attendance cost more than fuel. In the case of the scheme that Mr. Deacon and he had laid before the members, the wages of the attendant who resided at the pumping-station and half those of a lad was nearly twice as much as the cost of the fuel. Would the author state what was the cost of attention in this particular instance? Another thing which struck him was that the material parts and consequent risks of break-down were multiplied. He did not see that the author had provided a duplicate cable. Had the author also considered

bare overhead wires, because in an uninhabited district such as he had referred to, overhead wires offered many advantages? There was also the question of the instantaneous power, at the generating-station, to be compared with the rated power of the motor at the pumps.

Mr. F. W. Hodson (Loughborough) congratulated the author on the cheapness of his pipe-laying, and also on the cheapness of his reservoir. It would be interesting to know on what the costs were based. He would also be interested to learn what were the reasons for the adoption of the very expensive form of electric pumping at Scunthorpe. The only reason given in the paper was the inaccessibility of the pumping-station for carting fuel. They had 4 or 5 miles of cable, involving a heavy capital cost, a great deal of risk, and a great deal of waste; and afterwards the reconversion of the current by the motor into power at the pumping-station. With a bit of leather belt, and the engine at the end of it at the pumping-station, a great deal would be saved—generator, cable, motor, and three distinct sets of losses. The author stated that the efficiency of the generators was about 90 per cent. at the low load at which it was working. There was also another percentage on the cables which was not given—say, 90 per cent. again. Then for the 50-horse power motor working at half-load, 87 per cent. was given; and for the pumps, from 85 to 92 per cent. It seemed therefore that the figure of 87·4 per cent. must again have left something out. What he (Mr. Hodson) would like to know was the actual quantity of coal used per 1000 gallons of water pumped into the reservoirs, or some figure by which the members could compare the actual cost of pumping this water by electrical power as contrasted with direct steam or suction gas. That was where the great interest of this paper lay.

Mr. H. Preston (Grantham) said he had known the Scunthorpe works from their inception; and he had been interested in them chiefly from the geological point of view. He had also taken some interest in watching the development of the mechanical side. As to the mechanical arrangements, there had been some discussion regarding the Scunthorpe high-pressure centrifugal pump in connection with a previous paper; but he (Mr. Preston) thought it was scarcely understood at the time that the two systems—the three-throw pump and the centrifugal high-pressure pump—actually pumped through the same main. The difference between 4½ and 7 amperes, and the pumping heads of 180 feet for the three-throw pump and 260 feet for the centrifugal pump, were explained by some mechanical defect in the attachment of the centrifugal pump to the larger main. Referring to the particulars given by the author as to the original boring, Mr. Preston suggested that Mr. Cobban should publish the full sectional details, as well as the analysis of the water, in the "Transactions" of the Association. He added that, as there had recently been finished another interesting boring at Lincoln, it would be of value to the members if Mr. Barron or Mr. Percy Griffith would furnish similar particulars in regard to it.

Mr. George Greenslade (South Hants Water-Works Company) remarked that the members were greatly indebted to the author of the paper for giving them so much detail. One thing that particularly struck him was the extraordinary cheapness of the work that had been carried out. A question had been asked as to the wages paid. He (Mr. Greenslade) would like to inquire whether the work was done by contract or own labour. Another point was as to whether there was any special reason for the inlet-pipe for the reservoir being taken in at the top and carried to the bottom. He took it there were separate inlet and outlet mains. Information as to the cost of the Venturi meter and fixing would also be welcome; if the author could not give the cost precisely, a rough idea would answer the purpose. The consumption per head of the population would also be interesting.

Mr. W. Phelps (Shepton Mallet) thought there must be some mistake as to the efficiency of the whole plant, which was stated to be 87·4 per cent. Taking the guaranteed efficiency for the pump at (say) 90 per cent., and the guaranteed efficiency of the generator as mentioned in the paper at 90 per cent., it was evident they could not, even without any wastage, get a mechanical efficiency of 87·4 per cent. Perhaps the author would give a little more information on this point. He (Mr. Phelps) had not had any experience in electrical transmission; but from inquiries recently made, he had come to the conclusion that the losses on a short length of cable would be serious, and one would imagine it would be very large on this 4¾ miles. On another point, which was not mentioned in the text of the paper, he observed from the plans of the reservoir expanded metal appeared to have been placed in the centre of the concrete slabs forming the roof. This was quite contrary to the usual practice; and he thought contrary also to theoretical reasoning. He would like to know if it had actually been so placed. Regarding the concrete, he asked if it was Oolitic limestone that was used. He presumed it was. He had tried concrete composed of this material. It had not been in a great while yet, but so far it appeared to be satisfactory. He could, however, well believe that, under certain circumstances, it might be liable to deterioration.

Mr. Percy Griffith (London) said, as Mr. Preston had referred to the Lincoln boring, perhaps he (Mr. Griffith) might take this opportunity of—should he say?—"giving himself away." He found himself in very great sympathy with the author of the paper. He had described to the members very briefly, and, as Mr. Preston had said, rather too briefly, the details of his deep boring into the new red sandstone. Mr. Cobban's town was situated in North Lincolnshire. He (Mr. Griffith) was very sanguine that, having a successful boring into the new red sandstone at Gainsborough, which was geographically situated between Scunthorpe and Lincoln, that the result at Lincoln would have been satisfactory. But it was now clear that the governing factor with regard to the quality of the water was, as Dr. Thresh told them the previous day, the depth below the surface, and not the geographical position on the surface. The results at Lincoln were so very similar to those obtained at Scunthorpe, that it was more than probable, and almost a certainty, that the same causes had operated in both cases. It might interest members if he stated that the Lincoln boring was finished at a depth of 2200 feet; the diameter at the bottom being 24 inches. The water was tapped at a depth of 1560 feet; and in the course of 36 hours, it rose to the surface, and had ever since been overflowing at the rate of approximately 200,000 gallons a day (without pumping). When these conditions were first revealed, a favourable result was naturally anticipated. As regards yield, there was every prospect of obtaining 1½ million or even 2 million gallons per day, by pumping at a sufficient depth, but as the analyses of the water gave worse results as the boring proceeded, it was realized that the water was useless for public supply and the scheme would have to be abandoned. This was more than ordinarily disappointing, as the work involved an expenditure of more than £22,000 to the Lincoln Corporation. Naturally they were very disappointed; and he felt sure they would have the sympathy of all—especially engineers—interested in the obtaining of a good supply of water. As to the detailed information asked for by Mr. Preston he (Mr. Griffith) would undertake that the information should appear in the "Transactions," but for the moment he was not in a position to promise definitely to give the Association the first paper on the subject. He thought it would be interesting if he could induce Dr. Thresh to deal with the analytical data in a paper to be presented at the same time as a paper describing the engineering features of the case. As to the details of the Scunthorpe boring, he was going to anticipate Mr. Cobban's reply to that by saying that Mr. Preston was himself responsible for publishing these details in the "Geological Memoirs;" and all who were interested in the question of geology and water supply would have the "Memoirs" by them.

Mr. Preston supplemented his previous observations, by permission of the President, relative to the question of the use of limestone for concrete. He remarked that a short time ago he had to construct a small reservoir; and he intended to use local limestone for the purpose, but was advised it would deteriorate when the water got on to the concrete. He had some concrete which had been under water for something like eighteen years; and before he constructed the reservoir, he took up some of this, so as to try the experiment. He found the water had had no effect on it; he could not trace on the surface even a little decay. Where such a thing did take place, it was owing to an upland water being used which would act on the limestone, but where water such as their own was fully charged with carbonate of lime, it would have little action on the limestone.

Mr. Arthur Andrew (Oldham) asked whether the cost of pipe-laying included any item for reinstatement of roads. Usually, the cost of this item was not less than 9d.

Mr. Cobban, replying to the discussion, said if he answered the President's question as to the price of main-laying, he

should at the same time be giving a reply to several other members. He was pleased to say the prices quoted in the paper were the actual prices paid by contract. He had an excellent contractor; and all the work was by contract, and paid for on the contract price without any extras whatever; and the contractor had to provide all the yarn, the lead, and the tools, light, watch, and guard the excavation, and reinstate the roadway at the tendered prices, measured as laid. For the straight pipes and for the specials on the pipe-line, the figures in the paper were the actual payments on the certificate. As to the rate of wages paid, the contractor paid them; he (Mr. Cobban) had nothing to do with that. As to the question by Mr. Secker, who asked as to the expansion of the concrete by atmospheric influence, this was neutralized by the use of expansion joints and bitumen. Regarding the use of expanded steel in the roof of the reservoir, wood-centering was put in; this was covered with brown paper and oil or soft soap applied; then right over the top of the girders, the expanded steel in long sheets was hung, resting on the centering. The concrete was then put on; and it had a tendency to rise in the first 1 or 1½ inches of concrete. But it overhung the girders so as to make a light connection therewith. He had been asked about the rainfall, and whether there would be any use for an overflow. He had been labouring here with rainfall very much below the normal; and so he could not say whether or not the overflow would be used. The question had been raised regarding the use of limestone in the concrete; but Mr. Preston had answered that. He (Mr. Cobban) took particular care to select hard limestone. It had been used for many years for farmhouses; and he did not think there would be any disintegration. The softer limestone was utilized for footpaths and roads. Mr. Gore had put his finger on the only blot in all the scheme, and that was the cable. To neutralize the effect of only having one cable, access boxes were placed so that any fault in the cable could be localized very rapidly. The reservoir gave them storage of 750,000 gallons, so that would allow them time to run along their cables and localize any defect; and their own electrician could do this. Another question was asked as to the losses in transmission. The loss on the three-phase voltage (they were running at 2200 volts) was very small indeed—a drop of only 120 to 130 volts in the 2200. An inquiry was made as to the cost of the Venturi meter. He did not think his cost would be a fair figure to work upon. It would be found that the cost of the Venturi meter varied with the circumstances in which it was fixed; and any one case would not serve as a guide in another. As to the point made regarding the inaccessibility of the site, it was argued that if the site was inaccessible for the coal, it was also inaccessible for the pipes. But the pipes had only to be conveyed once; while the coal had to be conveyed every day. It was necessary therefore to convert the coal into a form of energy that could be easily transmitted. His power was in the nature of a bye-product of the gas-works. He did not need to use much coal under his boilers; any spare rubbish coming from the gas-works—such as breeze, coke, or even sweepings—would be used. His electricity, therefore, was more in the nature of a bye-product. He was supplying steam for the purpose of running plant at the gas-works—the tar-pumps, the ammoniacal liquor and water pumps, two exhausters, and other plant. Having the steam power plant at the gas-works, he went forward, and had a power-station there, and so generated the energy for the pumps. Regarding overhead wires, they were prohibited in his case. The estate was a big sporting one, and they were not allowed to put up overhead wires.

Mr. Peirce: If Mr. Cobban cannot give us the price of labour in this particular case, will he give us the average price in the district?

Mr. Cobban said the labour scale was a pretty good one. He believed they paid some of the labourers 6d. per hour; but most of the work was paid for by the yard.

Gaslight and Coke Company's Dividend.

We are informed by the Secretary of the Gaslight and Coke Company (Mr. H. Rayner) that the accounts for the past half year show that—subject to audit—the balance to the credit of the net revenue account will enable the Directors to recommend the payment of a dividend at the rate of £4 8s. per cent. per annum, carrying forward a balance of £306,992 6s. 10d. This result compares with a dividend at the same rate for the June half of last year, with a balance of £210,481 carried forward.

PHOTOMETRY OF DIFFERENT COLOURED LIGHTS

By M. Lauriol.

Chief Engineer of the Paris Roadways, and Chief Engineer of the Public Lighting of Paris.

[Translation of a Paper presented last Thursday to the International Photometric Committee.]

I.—Briefly, it will be taken for granted in the sequel that (1) the absorptive power of the air can be neglected, and (2) the dimensions of the sources or groups of sources of light are infinitely small in comparison with the distance from the objects illuminated. As most sources have different illuminating intensities in different directions, when the intensity of a source or the effect produced by it is spoken of, it will be understood that these expressions apply to a particular direction.

II.—Experience furnishes us with a first general law—viz., a source A, acting at a distance a, produces the same effect as a group of n^2 similar sources acting at the distance na.

When a source A is compared with a standard of the same colour E, the intensity of A measured relatively to E is by the definition the ratio $\frac{e}{a}$, which results from the condition that a group of sources e similar to E produces under all circumstances the same effect as a group of sources a similar to A. The law set out at the beginning of this paragraph admits of another definition of intensity being given—viz., it is the ratio $\frac{u^2}{v^2}$ which results from the conditions that the source A acting at the distance u produces the same effects as the source E acting at the distance v.

III.—The intensity so defined has, in monochromatic photometry, a perfectly clear meaning, and is indeed an inherent property of the source under consideration. The figure found is independent of the mode of measurement, and of all the circumstances of that measurement, of the nature of the effect which one endeavours to balance, of the absolute values of the numbers a and e on the one hand, and u and v on the other hand, &c. All the modes will theoretically be equally good; and choice will be guided simply by considerations of convenience or of exactness. The intensity of a group of sources is equal to the sum of the individual intensities of each source. The relation between the intensities of the two sources is independent of the common unit by which they are measured. To sum up, it is justifiable to state that the intensity so defined gives an exact measure of the value of the source.

IV.—When two sources of different colours are compared, the conditions are changed. The effects produced by two sources will not always be the same; but in certain cases it will be possible merely to judge that they are equivalent. This judgment carries a greater uncertainty the greater the difference between the two colours. Further systematic differences are introduced, depending on all the conditions of measurement. A source of light no longer has a certain intensity, but an infinity of intensities according to the mode followed, and with the same mode according to various numerical experimental data. The principal causes of variation will be enumerated later. Then there is the radical and absolute impossibility of saying that a source A is twice or three times the value of another source B. All that can be said is that in a first case, a second case, or a third case the source A had a value twice, or two-and-a-half times, or thrice the value of B. Which figure is to be chosen to represent the value of the source A? Scientifically, all these figures are properly applicable, if the conditions under which the measurement was made have been clearly defined. Practically, if a batch of conditions can be found corresponding more or less to the customary conditions of use of the sources of light, the measure thus made will give a more or less satisfactory measure of the value of the source.

Let us take an example from a somewhat different order of ideas. The relative volume of two masses of gas is a well-determined quantity, if the two masses are similar in character and both are at the same temperature and pressure, whatever that temperature and pressure may be. On the other hand, the number of litres occupied by a given mass of gas is not definite; and no one can say, without further qualifications, that a kilogramme of air occupies 1000 litres. If, however, it is known that the temperature and pressure vary only within certain sufficiently narrow limits, it will be possible to say that a kilogramme of air occupies a space of 1000 litres. The case of the photometry of lights of different colours is quite analogous.

Various definitions of the intensity of lights have been selected from among the many available. For instance, (1) the relative intensity of the sources after filtration through a monochromatic screen which allows only certain radiation at the limit of the yellow or the green to pass; (2) the limit towards which the relative intensity approaches when the illuminations approach zero; (3) the integral of impressions obtained on a photographic plate by making each radiation act in succession for a given time, which is a function of the wave-length. None of these definitions is *per se* good or bad. Do they correspond with the average conditions in practice? That is the only question. To accept or reject one or the other, comparison must be made with the average conditions in practice. After that, it is easy enough to take at the outset these average conditions, and to make the

measurements directly under the conditions. This is what the author purposes trying to do, without making any pretence of avoiding arbitrariness, but only giving it as small a part as possible.

V.—At the outset, we may somewhat ingenuously recall the fact that the sources of light enable us to see the illuminated objects. To keep to the general practical case, we ought only to depend on phenomena of light, sensible to our eyes, and consequently to photometers properly so called, and so to exclude apparatus such as the selenium pile, bolometers, or photographic plates. The figures thus obtained will evidently have no particular value for a medical man, who looks for certain physiological actions by a focus of light, or for a photographer, who looks for certain chemical effects, &c. But it is necessary to keep within limits.

VI.—Various physicians and physiologists—among others M. André Broca—have shown the influence which fatigue of the eye, more or less severe, and the duration of the impression of the light, cause on measurements. In an analogous train of ideas, the author has found variations of 20 per cent. in the relative intensity of a Nernst lamp and an ordinary electric glow lamp, according as it was measured with the Simmance-Abady flicker photometer as normally worked with the disc rotating, or with the same photometer with the disc at rest so that the equality of illumination was judged on the two juxtaposed surfaces at rest. Practically the objects, whether fixed or moving slowly, which are being observed, retain constant illumination for an infinite period (*i.e.*, a second or more); they are observed with an eye which has received the impression of the surrounding light for an infinite period (a second or more), and is fatigued to an extreme extent. We shall have to work under these conditions, which are those obtaining in all photometers with fixed surfaces, to the exclusion of flicker photometers.

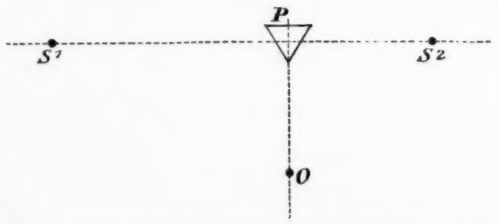
VII.—The apparent diameter of the surfaces of observation appears to have an influence, which is still imperfectly known, on the results of the measurements. It would appear that, according as this diameter varies, the image reaches or fails to reach various parts of the retina of varying susceptibility to impressions. Practically illumination is of most value to us in the direction determined by the eye, or in its vicinity. Consequently, tests should be made to ascertain a maximum limit for the diameter viewed, below which we ought always to stop.

VIII.—Objects of every colour have to be observed set on backgrounds of every colour; and in this lies the possibility of the relative values of two sources varying to a very great extent. A weak source of green light will be superior to a powerful source of red light, if green objects have to be distinguished on a black ground or red objects on a white ground, or *vice versâ*. A single measurement of the relative intensity of the two sources will therefore give a figure differing very greatly from their true relative value under different conditions. The least objectionable solution in such a case will be to compare the illumination of two white surfaces, just as is done in the majority of photometers.

IX.—The intensity found varies with the absolute illumination. this is one of the facts which have been investigated longest. For instance, the intensity of a Nernst lamp, measured relatively to that of an ordinary electric glow lamp, has been found to vary between the ratios of 100 to 80 and 100. In this instance, the absolute illumination varies within less wide limits than those between which it varies in practice. In this special case, it is noticeable that the variation is not in a constant sense. It is scarcely possible to choose an average condition. There are variations from 1000 *lux* to 0·1 *lux* between the maximum illumination of a work-table and the minimum illumination of a public street. In general, the sources ought to be tested over these limits; but it is between 50 *lux* and 0·5 *lux* that the measurements are specially of interest.

X.—The intensity found varies as a function of the absolute illumination, but of the absolute illumination of what? Clearly it can only be as a function of the illumination of the images on the retina. Therefore every cause which produces variation of the illumination of the images on the retina, while the illumination of the photometric screen remains constant, will produce a variation in the figure found for the relative intensity of two sources. If, when making an observation, we wink, or obscure the pupil of the eye, we cause the illumination on the retina to vary, and we observe variations of the apparent relative intensity. This fact has been pointed out by M. Laporte. It will be seen that only one thing can be done in this connection—viz., to keep the eye naturally open when making an observation, and to compare the results obtained by different observers.

With identical illumination of the photometric screen, the illumination on the retina varies with the photometer used, according to the reflections, refractions, diffusions, and absorptions inherent to each instrument. Also, it will be found that, for the same distance between one of the sources and the photometer, the apparent intensity varies with the photometer used. We ought therefore to select a photometer which reduces to a minimum all these modifications of the light, and which shows us the screens as nearly as may be like we see objects in general practice. Generally we observe matt opaque surfaces at all possible angles of incidence. As an average, let us assume that the incident ray and the visual ray are perpendicular to one another, and are both at 45° to the vertical. Between the source and the eye, the light undergoes no other modification than diffusion at the surface of these objects. It ought to be the same with our photometer. Therefore the author suggests the following method with which



some observations have been begun. On a rectilinear horizontal bench are mounted the sources of light S^1 and S^2, and the photometer P (see annexed figure). The latter consists of an isosceles rectangular prism, with vertical edges. The plane bisecting the angle ought to be perpendicular to the direction of the bench. The eye is put at O in the bisecting plane, at the same height as the photometer and the sources of light. The prism is made of plaster, unglazed porcelain, or any other white matt material. The edge of the facing angle ought to be as sharp as possible. Equality, or at least equivalence of the illumination of the two lateral faces of the prism, is obtained by moving either the photometric prism or the sources of light.

Such a photometer affords a less precise observation than others—such as the Lummer-Brodhun; but it comes nearer to the average conditions of practice, and avoids systematic errors. There is greater reason still for discarding photometers in which the light traverses a translucent screen, like Foucault's photometer, and more particularly the grease-spot photometer, as the phenomena differ too much from the ordinary conditions of practice.

XI.—The intensities being thus measured, the following law (which the author brings forward with all reserve, as it has not yet been sufficiently verified) appears deducible from the tests: *Two illuminations which are equal to a third are equal to one another.* Suppose that the two following results had been found:—

The source A at the distance *a* is balanced by the source C at the distance *c*.
" " B " " *b* " " " " C " " " *c*

Then the law cited would indicate that—

The source A at the distance *a* is balanced by the source B at the distance *b*.

If this law were more completely verified, granting the laws of variations of the relative intensity of two sources A and B, and of two sources A and C, we should be able to deduce from it the law of variation of the relative intensity of the two sources B and C. Thus, from the two data—

A at the distance *a* is balanced by B at the distance $f(a)$;
A " " " *a* " " " C " " " F (a);

we should deduce that

B at the distance $f(a)$ is balanced by C at the distance F (a).

Giving *a* all possible values, we should then have the law of variation of the relative intensities of B and C. Given the law of variation of intensity of a source by reference to a primary standard, and that of this standard by reference to a secondary standard, the law of variation of the intensity of the source in relation to this secondary standard may be deduced.

XII.—When all this is done, there are still troublesome considerations in the way of conducting the photometry of lights of different colours, which at any rate render it necessary to make very numerous observations in order to get a result having any meaning. The intensity of a group of sources of light is, generally speaking, different from the sum of the individual intensities of the sources. There is notable inequality in the case where each source is placed separately, and later the whole group, at the same distance from the photometric screen.

The law of variation of the intensity of a source, as a function of its distance from the photometric screen, will not remain the same if the standard used for the measurement is altered. If the intensity of the standard is simply modified, without altering its colour, a curve can be deduced from the other curve by increasing or diminishing the ordinates in constant proportion. If the colour of the standard is modified, measurements such as those indicated in Section XI. will have to be resorted to. Generally, it will be inexact to multiply the ordinates of a curve by the ratio of the intensities of the two standards, as determined by a single observation on any photometer, and with only one distance between one of the standards and the photometric screen. In particular, for comparing the three standards, the Carcel, the Harcourt, and the Hefner, it would be interesting to have a detailed investigation made with various illuminations and various photometers.

XIII.—Though the intensity of the standard is theoretically a matter of indifference, its colour is not. As comparison with natural sunlight is desirable, a standard should be chosen which comes as near as possible to the colour of sunlight when atmospheric absorption is at a minimum. So judged, the Carcel and the Harcourt standards appear superior to the Hefner. Perhaps a better may be found.

XIV.—In many cases, comparison is between lights of almost the same colour; and no comparisons have to be made with other lights of different colours. For instance, in comparisons of Welsbach burners of different makes one with the other, the chief interest lies in ascertaining their value relatively to one another without troubling greatly about their value relatively to a Carcel lamp or an electric arc. Or the variations of intensity

of a source of light with change of direction might be studied In each of these cases, it would be convenient to adopt a special standard of appropriate colour, rather than to refer both to the same standard. For instance, special standards would be used for Welsbach mantles, others for hydrocarbon flames, others for incandescent electric carbon lamps, others for lamps with metallic filaments—such as the osmium, tantalum, or tungsten lamps—others for ordinary arc lamps, and others for flame arc lamps. Comparison rests each time only between two sources of the same colour; and there will no longer be any reason for limiting oneself to the use of the photometer mentioned in Section X. In order to make the tests carried out in different laboratories comparable, it would be possible, for instance, to start with the general standard mentioned in Section XIII., and to filter the light through various coloured screens, either of thick glass of well-defined composition, or of liquids, as in Crova's green screen.

XV.—The various causes of variation of the apparent intensity of two sources will have so much the less effect, and may be so much the more readily neglected, when the colours are but little different, and no very great degree of precision is aimed at. It is important to make long series of measurements on this point, principally with colours much whitened, as is the case with the most general sources of light. The collaboration of numerous laboratories would be useful to this end.

XVI.—To sum up, the author submits this programme: Try the photometer described in Section X. Investigate the discrepancies due to difference of eyesight. Investigate the effect of the apparent diameter of the screens, and, if it seems desirable, fix a maximum diameter (Section VII.). Compare the Carcel, Harcourt, and Hefner standards with the photometer described in Section X., and investigate the variations of relative intensity as a function of the absolute illumination and of the various photometers employed. Verify the law of illumination referred to in Section XI. Choose a primary standard having, as nearly as may be, the colour of solar light (Section XIII.). Choose secondary standards having the colours of the various common sources of light (Section XIV.). Make measurements of intensity in the photometry of different colours for illuminations varying from 1000 *lux* to 0·1 *lux*, and in particular for illuminations ranging from 50 *lux* to 0·5 *lux*. Investigate the degree of approximation to accuracy with which it is possible to assign a particular intensity to each of the various common sources of light (Section XV.).

Thorium-Cerium Mixtures.

In a recent number of the "Berichte des Deutschen Chemischen Gesellschaft," the subject of thorium-cerium mixtures was dealt with by Herren R. J. Meyer and A. Anschütz. According to an abstract in the "Chemical News," the authors contended that an incandescent mantle of pure thorium oxide is not luminous because it is perfectly transparent to almost all wave-lengths; but the addition of a coloured substance, such as cerium dioxide, produces the characteristic luminous effect. The maximum of radiation when 1 per cent. of cerium dioxide is present represents the upper limit at which the increase in the power of emission caused by the increase in the amount of cerium is not appreciably affected by the disturbing influence of the ultra-red emission. Regarding the question from a chemical point of view, if such oxide mixtures are solid solutions in which the component present in excess—viz., thorium oxide—represents the solvent and the other the solute, it remains to be decided between what limits the two oxides are homogeneously miscible with one another, and whether chemical individuals are formed. These questions would easily be answered if it were possible to determine the melting-points of mixtures of different composition, which, however, is not feasible. There is also the question whether in such mixtures the cerium is actually present as dioxide and not wholly or partly as sesquioxide. To investigate this point, the authors first tried to ascertain whether any oxygen escapes when thorium oxide and cerium oxide solutions are evaporated together; and they obtained a negative result. However, the method employed was open to objection; and hence the active oxygen in the synthetic oxygen mixture was determined iodometrically. It was then found that only a certain part of the cerium used reacts with hydriodic acid, liberating iodine; and thus some of the cerium has been brought into the passive state—*i.e.*, some of the cerium oxide suffers a change, and loses its oxidizing properties. Further experiments show that homogeneous solutions of the two oxides can be prepared up to a maximum of 7 per cent. of cerium oxide; but it is not certain whether this maximum percentage represents a compound of 93 per cent. of thorium oxide and 7 per cent. of cerium oxide, which would have the formula $9ThO_2.CeO_2$. It is possible that the maximum effect is produced when 1 per cent. of cerium oxide is present, because the emission of light does not proceed from the whole mass of dissolved cerium, but from the dissociated parts; and that the maximum of effect corresponds to that dilution at which the solution is completely dissociated.

The Council of the Institution of Civil Engineers have appointed Sir William Matthews, K.C.M.G., the President, to succeed the late Sir Benjamin Baker as one of their representatives on the principal Committee of the Engineering Standards Committee.

THE BLOCK LIGHT.

Extension of Home Manufacture of Mantles.

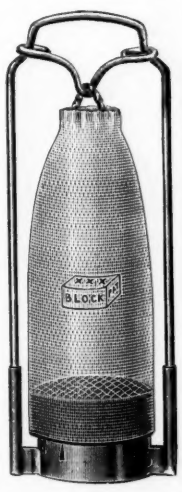
It was only a question of time when the manufacture of incandescent gas mantles for home consumption would become largely concentrated in this country. The process has been going on; and the assertion of interested parties that incandescent mantles could not, owing to climatic influences, be made so well in this country as in others, has long since been nullified beyond all hope of further credence. There are mantle manufactories in this country of extensive capacity, and specially designed for the work, which are now permanent institutions, and which have brought to England a new industry. We will not name them all here, as most of them are well known. It is the latest of the establishments that call for notice to-day, in view of a special invitation, issued to interested technical and trade papers to go and inspect them, witness the processes, and state what was seen, with the impressions of the visitors. The Block Light, Limited, Clifton Buildings, Worship Street, issued the invitations; and from these commodious premises (from which all the executive and commercial work of the Company is transacted) the visitors first repaired to their newly established factory at Barnes.

New Features in Commercial Policy—A Three Months' Guarantee for Mantles.

But before leaving the City premises, some information was imparted which is of interest. In the first place, it was gathered that the mantles of the Company have hitherto been made in France and Germany; they will now be made entirely in this country by British labour. And the time is not far distant when we shall be able to write the same of their burners. That is the Company's manufacturing objective, for the double purpose of having the producing work directly under supervision, and in order that they may come before the British public with home-made goods as one plank in their commercial platform.

Then another thing is that a three months' guarantee from date of purchase is given with certain brands of their mantles; and a three months' guarantee is a thing that strikes us as novel and bold in enterprise in the mantle world. The risks that are involved by the Company in this matter are many. They

The Block Burner.



The "Anti-Vibro" Mantle.

however, have every confidence in their proposition; and where they lead in this, they believe others will follow. Of course, the mantle is only renewed in the event of its breakage otherwise than by accident.

Further, the Company are giving the public the benefit of administrative and manufacturing economies by reducing prices; and they have made comprehensive regulations whereby the maintenance of prices will be assured in the trade (or rather it is hoped the regulations will be efficacious in this respect). Again, for the coming season they are supplying burners and mantles, in sealed boxes, at lower prices than hitherto; the object of the sealing being to prevent any tampering, on the part of unscrupulous dealers, by exchanging the productions of the Block Light Company for others of inferior make.

An Inverted Burner for Ordinary Mantles.

An object of interest that was also described at the offices was an inverted burner, made to take ordinary mantles. Incandescence of the longer mantle is obtained by perforations in the bunsen tube at its lower part. The whole of the mantle—that is to say, the upper part—is not rendered incandescent; but the illuminating power and general effect are stated to be good. We have not yet seen one of these burners; and therefore cannot speak of merits from personal experience or observation. But the novelty is worth mention.

At the Barnes Factory.

The Barnes factory, which has been established under the title of the London Mantle Company, Limited, has been specially adapted to mantle making; and everywhere one notices arrangements tending to economize in the system of manufacture.

Passing through the factory, the information is first gathered that, at this commencing stage, the equipment of the buildings is equal to an output of 7½ million mantles a year; while provision has been made for the extension of the plant and accommodation of employees to raise the productive capacity to 15½ millions per year, apart altogether from the production by the English Gas Mantle Company of mantles for the Block Light Company. Introduction was made to the knitting department, where, in describing the machines Mr. J. W. May (of the central office), who accompanied the party, informed them that the Company prefer to use cotton, specially prepared and unshrinkable, for their mantle fabrics; they claiming that it is better than ramie. Thus do specialists disagree. However, each of the knitting-machines is equal to the turning out of sufficient fabric for 2500 mantles per working day; and the labour required of the attendant is very light. In passing, it was remarked that electrical driving is the fashion here. Exceeding great care is taken in the preparatory work in manufacturing the mantles; and there is not a point in the detail upon which Mr. J. I. Robbins, the Manager, has not exercised a wise discrimination, and brought his mechanical bent to bear. In the buildings, which are themselves airy, light, and capacious, everything has been done to ensure cleanliness of operation and purity. An instance is seen in the precise methods adopted in the successive washing in different large tanks of the knitted fabric before impregnation. After this washing, the fabric is taken to a drying-floor running centrally under the roof of the spacious room where the burning-off operations are performed. The sides of this elevated corridor floor are only partially enclosed, so as to permit the heat from the burning-off machines below to ascend here, and supply the heat for drying. There is economy in this; and so great is the waste heat thus utilized that the temperature attained on the floor varies from 109° to 120° Fahr. The dried fabric is subsequently carefully examined; and any damaged portion is cut out and discarded. Then comes an ingenious arrangement of impregnating bath and mechanically worked rollers combined. The fabric is dropped into the impregnating bath; and then passed between a pair of rollers, set to a certain pressure, according to the weight of chemical it is desired to retain in the fabric. Adjoining the impregnating department is a drying-room, which was found at the time of the visit to be at a temperature of 93° Fahr., at about which degree the temperature is maintained by electric and gas heaters. Here the impregnated fabrics are suspended on drying-bars, and left for about forty minutes. Then we were taken to witness all the other well-known processes—the cutting in lengths, the strengthening and sewing of the heads of the mantles, the stamping, the burning off, the collodionizing, the fitting to "Anti-Vibro" frames (there are, of course, classes of mantles not so fitted), the trimming, examining, boxing, and so on. Regarding the burning-off, gas is used at 10 lbs. pressure, to which point it is raised by an air-compressor. In the portion of the building where the work of collodionizing is performed, it is noticed that the fumes from each machine are drawn upwards by a fan, into a hood, leading to a ventilating-shaft; and below there is also a grating through which any descending fumes are drawn, also by a fan. Each of the collodionizing or dipping machines at present installed is equal to treating 8000 mantles per day. Altogether there are 250 hands employed in this newly started factory; and this number will be progressive as the equipment proceeds.

At the English Gas-Mantle Company's Factory.

From the Barnes factory, motor cabs that had been chartered for the party took them to the large factory at Streatham of the English Gas-Mantle Company, where are made some of the Block mantles, and, in accordance with specifications, several others of well-known name in the British market. Members of the Board of the Block Light Company are also interested in the direction of this mantle company. This is the factory of which Mr. J. T. Robbins is the Managing Director; and we find here an old hand in the technical work of the incandescent mantle industry—Mr. W. Mackean, whose knowledge of the chemistry of the subject from the manufacturing side may be rivalled, but certainly not exceeded. This factory at Streatham was formerly specially built for the Dura Company; and it is laid out on the lines that experience has advised are the best, for both work and employees. Here there are spooling, knitting, and other machines equal to an output of about 17 million mantles a year; and plenty of room for more. All sorts and sizes of mantles are made at the establishment—both for vertical and inverted use.

A Machine Dealing with Several Processes.

But the great feature of the factory are the Robin machines, which are the invention of the Manager. They are remarkable for their labour-saving capacity. There are eight of these machines, each being equal to treating 4500 mantles a day, or 1¼ millions a year; and only two young girls are required to feed the machine and receive the finished mantles. The machines take up all the work after the impregnation of the mantles; and the mantles go through all the subsequent processes with time-regulated precision, the mantles being delivered in perfect condition ready for boxing. The combination of processes is ingenious; and the efficiency of the machine appears to be very high. This is the only factory in this country so far equipped with these machines; and they have been working with great satisfaction for six months. But there are fourteen others in Germany and two in France. For the high-pressure burning off, the air to the burner is compressed, and not the gas.

All other operations are similar to those obtaining in other factories. The motive power for the machinery is gas-generated electricity, which is useful in such an establishment where power is required at so many points distant from each other. There is a modernness about the whole place which is pleasing; and there is abundant space everywhere which facilitates the different operations. Just now, nearly 300 hands are employed; but in the height of the lighting season, there will be from 500 to 600.

NOTES ON TAR MACADAM.

At a recent Annual Conference of the Association of Municipal and County Engineers in Liverpool, Mr. C. F. Wike, M.Inst.C.E., of Sheffield, read a paper on the subject of tar macadam, with special reference to its use in connection with road making in his town.

The author began by pointing out that the employment of tar macadam for minimizing dust—for which purpose he said it was probably the best material—was by no means a recent introduction—it having been resorted to in some of the Northern and Midland towns for at least thirty or forty years. In Sheffield, tar macadam had certainly been laid nearly forty years. At present there were 392 miles of road in Sheffield, of which 241 miles were of macadam. About 151 miles of the latter were repairable by the highway authorities; and of these nearly 10 per cent. were laid with tar macadam. The proportion might seem small, but the reason for this at once brought them face to face with one of the difficulties in the general adoption of the material named for roads. Many of those in the writer's charge had steep gradients, and no one who had had any experience of tar macadam would suggest that it was a desirable material for hills. Up to the present, a gradient of 1 in 20 had been considered sufficiently steep. At one time, most of the work was let by contract; and this was still the case to a limited extent. But about five years ago plant was constructed by the Corporation at an approximate cost of £1000—consisting of sheds, iron-plated floors, with flues beneath for drying the broken stone, and heating apparatus for the tar compound. During the last three years the quantity of tar macadam prepared had averaged 2300 tons per annum, in addition to 900 tons of tarred chippings for footpaths.

The specification to which the tar macadam was made was as follows: First coat about 2 inches in thickness of limestone, "dark" in colour, and of approved quality, sound, hard, and free from spar; the stone to be broken uniformly to a 2½-inch gauge. Second coat about 1¼ inches in thickness, of best slag, of sound, uniform material, free from honeycomb and dirt, from approved works. The slag to be broken uniformly to a 1¾-inch gauge. Third coat about ¾-inch in thickness, of slag shingle to a ¾-inch and ½-inch gauge, in equal proportions, free of dust, of the quality specified for the second coat. The total thickness of the tarred material being rolled with the steam-roller to be 4 inches, and the top of its surface to be ¾-inch, above the level of the channels. After rolling, the roadway was to be covered with a dressing coat of granite or limestone chips (½-inch dust out) of approved quality and thickness, as ordered, and again rolled. The whole of the limestone and slag must be thoroughly well dried on hot plates. A mixture of pitch and tar must then be boiled in the following proportion: For the first and second coats, 90 gallons of tar and 125 lbs. of pitch; and after boiling for two hours, 17 gallons of the mixture must be mixed with 30 cwt. of the broken limestone and 1¾-inch slag. For the third coat, 14 gallons of the above mixture, after boiling, to be added to each cubic yard of shingle. The limestone and slag to be perfectly dry and warm at the time of mixing, and the whole thoroughly turned over, so that every part of the surface of the stones would receive a coating of the mixture. The above-mentioned proportions might vary according to the quality of the pitch and the strength of the tar. The prepared limestone and slag were then to be put in separate heaps, and left a sufficient time to toughen before being laid. After it had been properly toughened and freshened with a further quantity of pitch and tar (if this was considered requisite), it was to be spread on the foundation in layers as specified.

The cost of slag and limestone tar macadam was about the same. If of best quality, probably slag was the better material, and, in certain instances, it had been used for all three coats. The difficulty, however, was to get it sufficiently uniform and free from lime and other constituents which rendered it liable to early disintegration. This was one of its disadvantages as compared with limestone, which could be obtained of uniform hardness; and as the use of tar macadam increased, so would the difficulty of getting sufficient slag of suitable quality. Granite had not hitherto been looked upon as a suitable material for tar macadam, on account of its want of absorption. It was laid by the author nearly twenty years ago in several streets; but, for the reason

given, it was not a success. It had recently been laid in some districts, with tarred chips for binding; and similar work was in preparation in Sheffield. If the necessary adherence could be obtained, granite would, on account of its better wearing qualities, be more economical than either limestone or slag; and, perhaps, with modern methods of tarring roads again at frequent intervals, the old difficulty might be got over.

With regard to the cost of tar-macadam roads compared with dry granite macadam, the initial cost was about the same—2s. 3d. to 2s. 6d. per superficial yard, exclusive of foundations; the extra expense of tarring being balanced by the fact that a cheaper material was used than the granite macadam usually employed for important main roads, when these were not paved. Statistics had been prepared with regard to a typical suburban road taking a considerable amount of traffic; and the annual charge (including initial cost) for a period of fourteen years had averaged 4d. per square yard. This was for a fairly flat road. In another case—a road with light traffic—the average had been a little less than 2½d. per square yard.

If the best results were to be obtained, it was very advisable that, after the first laying, tar macadam should be kept in thorough repair; and for many years it had been the practice to tar-paint the surface at intervals of three or four years, or as soon as any roughness began to show. This had been done, not so much with the idea of laying the dust, as to prolong the life of the tar macadam. At present a considerable mileage of dry macadam road was being tar-sprayed; and, so far as could be seen up to now, it would be practicable to apply this system to gradients steeper than those upon which tar macadam had been laid. Nevertheless, there must be a limit to the gradients upon which tar could in any form be safely employed, as it was a material very susceptible to heat, and slippery in hot weather.

To sum up the writer's experience, tar macadam was a suitable and economical material for many situations, and its use was bound to increase; but it had its restrictions—the principal one being that it could not be safely used for roads with a considerable gradient. So far, the materials employed had been inferior in durability to granite or whinstone; and therefore it had not been suitable for macadam roads with the heaviest traffic. The great advantages were the comparative absence of dust, and the quietness. Roads of tar macadam were also economical in the matter of cleansing. The introduction of tar-spraying apparatus had materially helped to minimize the dust nuisance; and it was through the application of tar, in one form or another, that the nearest approach to a dustless road must be looked for where paving (which, after all, created the least dust) could not be used.

In the course of the subsequent discussion, Mr. E. P. Hooley, the County Surveyor of Nottingham, remarked that after experimenting in almost every possible way, tar seemed to be the one cheap and suitable material to form adhesive matter in road construction. At the same time, tar by itself would undoubtedly not make good roads; but if it could be made to adhere permanently to any good road material, and that material could be obtained at a cheap rate, it necessarily followed that many of the expensive parts of road making could be economically dealt with. While looking for a material which would be suitable for road making, and, at the same time, cheap in its initial cost, he found that a large quantity of furnace slag was yearly cast to waste, and that by a somewhat simple process all slag, or slag which had been considered unsatisfactory for road making, could be converted into a hard and truly efficient road material. But the difficulty in the ordinary treatment of slag with tar was that the material had to be warmed before it would allow of the tar penetrating its pores. The more it was warmed, the more the tar penetrated. While this warming process was being carried out, however, the fact of making the slag very hot also made it very brittle; and thus, while making it a suitable material for footpaths and light wear, it made it a most unsuitable material for roads.

Mr. J. Walker Smith, of Barrow-in-Furness, agreed with the previous speaker and with Mr. Wike that tar macadam, in some form or other, was the road-construction material of the future. So satisfied had he made himself upon this point, that at Barrow they had recently amended their standard of classification for the construction of streets; and no street would be made with other material than tar macadam. They had arrived at this conclusion after many mistakes and failures; and he thought they had now managed to make a tar macadam which, if not capable of bearing the heaviest traffic, was certainly standing very considerable traffic from motor-cars and motor-waggons. Mr. A. J. Pryce, of Lytham, thought there could be no question as to the road of the future being a tar-macadamized one. On sanitary and economic grounds, as well as for vehicular traffic, it would make almost an ideal road. The success of a tarred road would depend upon the way in which the tar was boiled. Alderman A. G. Turley, of West Bromwich, said they had tried tar macadam about twelve months ago. They got their Surveyor (Mr. Greatorex) to experiment upon the High Street, which was one of the hardest-worked roads in the district. He put on 4 inches of slag and tar—two coats, which had been down for twelve months, and it had certainly stood exceedingly well. Mr. J. S. Brodie, of Blackpool, said he had made tar-macadam roads for the last twenty years. He would not say that all had given him satisfaction, but the cause had generally been careless workmen or defective material, or something quite apart from the principle of mixing slag or limestone with tar for securing a good impervious road.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills read the third time and passed: Bude Gas Bill; King's Norton and Northfield Urban District Council Bill; Penrith Urban District Council Bill; Worthing Gas Bill.

An appeal in the case of *Cleverley and Others v. Gaslight and Coke Company*, which was before the Court of Appeal on the 10th ult., as recorded in the "JOURNAL" for June 18 (p. 825), was presented last Thursday; and the respondents—the Company—were ordered to lodge a printed case in answer thereto on or before the 29th prox. A petition of the appellants for leave to prosecute their appeal *in forma pauperis* was read and referred to the Appeal Committee.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Lords Bills read a second time and committed: Broadstairs and St. Peter's Urban District Water Bill; Portishead District Water Bill.

Lords Bills reported, with amendments: Renfrewshire Upper District (Eastwood and Mearns) Water Bill, Selsey Water Bill.

Lords Bill read the third time and passed: Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water-Works Bill; Great Yarmouth Water-Works and Lowestoft Water and Gas Bill; Tees Valley Water (Consolidation) Bill.

HERTS AND ESSEX WATER ORDER.

Nazeing Parish Council's Consent Dispensed With.

In compliance with the provisions of the Gas and Water Works Facilities Act, 1870, the Board of Trade have reported to the House of Commons that, in making the Herts and Essex Water Provisional Order, they have dispensed with the consent of the Nazeing Parish Council, who are the Local Authority for a portion of the district included in the limits of the Order. The application for the Order was made by the Herts and Essex Water-Works Company, Limited, and was for power to extend their authorized limits of supply so as to include the parishes of Roydon, Great Parndon, Little Parndon, and Nazeing, in the county of Essex, and to raise additional capital. All the necessary consents were obtained, with the exception of that of the Nazeing Parish Council; and the promoters asked the Board of Trade to exercise their powers and dispense with it. The Board accordingly held an inquiry, and invited representatives of the Council to be present. The Chairman attended, and stated that he thought the Council would have no objection to the Order provided that it would not involve any charge upon the rates, and that there was no compulsion to take water from the Company. In these circumstances, and in view of the fact that the consent of the Epping Rural District Council, in whose district the parish of Nazeing is situated, had been obtained, it did not appear to the Board that there was any ground for refusing to grant the promoters the powers asked for, as regards the parish in question. They therefore decided to dispense with the consent of the Parish Council and grant the Order.

Automatic Machines and the Bronze Coinage.

According to the annual report of the Deputy-Master of the Mint, issued last Wednesday, one of the curious facts of the year was the excessive demand for bronze coin, especially pennies; and he has endeavoured to discover the reason for this. He finds that the demand is chiefly due to the rapid development of automatic machines operated by pence. A series of inquiries he made among companies and local authorities who supply gas and electricity on the "penny-in-the-slot" system, companies who provide sweetmeats, matches, and other things from automatic machines, railway companies, and others, leads him to the remarkable conclusion that upwards of 60 million pennies, valued at £250,000, are continuously locked up in these machines, and consequently permanently withdrawn from circulation. "The effect of this on the recent demand for bronze coins can be realized," adds the Deputy-Master, "when it is remembered that this amount exceeds the total issue of pence for the three years 1903-5."

Birmingham Gas-Fitters' Association.—In reviewing, at the third annual general meeting, the work done by the Birmingham Gas-Fitters' Association during the past year, the Chairman (Mr. John Thacker) said their main efforts had been to put a stop to the evil of direct trading; and great headway had been made. Six firms had been approached, and satisfactory arrangements made that where this direct trading was indispensable a commission should be reserved for the local gas-fitter. The Committee had interviewed Mr. Hampton Barber, the Secretary to the Corporation Gas Department, and obtained revised prices in connection with fixing services, which would be of benefit to members. They had also arranged that a certain number of members of the Association in different parts of the area of supply should act as agents and display cookers as supplied by the Gas Department; and the Committee felt that this was a very valuable concession. Mr. Wiltshire said he thought the number of members to exhibit these cookers should not be limited, but should include all who had applied, and who had suitable premises.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Workmen's Compensation Statistics at Sheffield.

SIR,—I notice that at the recent meeting of the Institution of Gas Engineers a resolution was passed requesting the Council to appoint a Committee to consider the question of insurance under the various Workmen's Compensation Acts; and I have thought that possibly the experience of this Company may be of some interest to your readers. When the first Act came into operation in July, 1898, a report was presented to my Directors showing the number of accidents that had occurred during the previous two years; and from the statistics then compiled, they decided to set aside a sum equal to 6s. 8d. per cent. on the total wages paid by the Company.

The following table gives the number of accidents that have been paid for, the amount set aside by the Company, the sum paid in compensation, and the balance in hand at the end of each year commencing December, 1898, and also what extra compensation would have been paid had the 1897 Act contained the same provisions as the new Act.

It will be seen that, after the settlement of all claims, there was a balance in hand of £709, but that under the new Act this balance would only have been £223, which would have been a very small sum to have accumulated after 8½ years' working, and would not be sufficient provision for any serious accident that might result in the death of several men. My Board have therefore decided to increase from the 1st inst. the sum set aside from 6s. 8d. to 8s. per cent. on the amount of wages paid. This additional 1s. 4d. per cent. would have amounted, on the 8½ years that the Act has been in force, to £502, which, added to the balance we should have had in hand had the provisions of the new Act applied during that period, would have left us with £725—very much the same as we have actually accumulated under the 1897 Act.

In getting out the particulars for the above table, some very interesting points have come under notice. For instance, it has been found—certainly contrary to what I and probably most people would have expected—that the accidents due to machinery have been extremely small. Only 22 such cases have occurred during the 8½ years; and the sum

WORKMEN'S COMPENSATION ACT.—COMPANY'S FUND STARTED JULY, 1898.

Year.	Number of Men.	Total Wages Paid.	Number of Accidents causing Absence of over 14 Days.		Amount Set Aside for Compensation, being 6s. 8d. per cent. of Wages Paid.	Amount Paid in Compensation.	Balance Dec. 31 each Year.	Number of Accidents causing Absence of over 7 Days.		Under 1906 Act.		—
			Total.	Per Cent.				Total.	Per Cent.	Compensation would have Amounted to	Leaving Balance of	
		£			£	£	£			£	£	
1898	1159	41,953	6	0·51	139	15	124	12	1·03	35	104	6 months only.
1899	1273	89,702	8	0·62	299	125	298	21	1·65	265	138	
1900	1255	97,222	25	1·99	324	525	96	40	3·18	580	£118	*deficit.**
1901	1327	98,950	19	1·43	330	114	312	33	2·48	165	47	
1902	1220	91,153	15	1·23	304	266	349	32	2·62	328	23	
1903	1151	85,311	13	1·13	284	108	525	22	1·91	148	159	
1904	1103	83,760	17	1·54	279	250	554	32	2·90	289	149	
1905	1097	82,036	18	1·64	273	339	488	34	3·10	377	45	
1906	1129	83,134	21	1·86	277	56	709	31	2·74	99	223	
		£753,221			£2509	£1798 Or 4s. 9·29d. per cent. on wages.				£2286 Or 6s. 0·84d. per cent. on wages.		

* Two fatal accidents occurred in this year.

paid in compensation for machinery accidents has only amounted to £97 12s. 5d., or 5·43 per cent. of the total paid for all kinds of accidents. Then, again, it might be thought that at our new works at Grimesthorpe, where there was more ample space allowed for the men to move about, there would have been fewer accidents than at the older works. But this has not been so. It will be observed that the percentage of accidents at Grimesthorpe was greater than at either of the other stations.

Accidents for 8½ years from July 1, 1898, to Dec. 31, 1906.

	Average number of men employed.	Average number of accidents per annum.	Percentage on number of men employed.
Neepsend	476	15·41	3·27
Grimesthorpe	270	12·94	4·79
Effingham Street	155	4 71	3·03
Street men, fitting department, meter and stove repairers, &c.	287	3·88	1·35
	1188	36·94	3·11

The following list shows the ages of men to whom accidents have occurred; and this bears out a statement made by Sir George Livesey some time back that the larger proportion of accidents happen to the younger men, and that men as they get older become more careful and steady at their work.

Age.	Total number of accidents including trivial accidents for which no compensation was payable.	Percentage at each age.
Under 20	27	8·60
,, 30	98	31·21
,, 40	81	25·80
,, 50	62	19·74
,, 60	39	12·42
Over 60	7	2·23
	314	100·00

I am aware that these particulars would be more valuable if I were able to give the ages of all the men in our employ; but I feel sure that my Company have as large a number of old servants as most other gas undertakings.

Sheffield United Gaslight Company, July 18, 1907. HANBURY THOMAS.

Capital Expenditure of Gas Companies and Local Authorities

SIR,—The letter from me which you were so good as to publish last week was by no means intended to be a categorical answer to your observations, which I only cursorily glanced at—so cursorily, in fact, as to miss the question which you have repeated in your foot-note. Let me say at once in reply to this that I consider my comparisons to be absolutely fair, or I would not have employed them. They show that which has been apparent for years—namely, that the local authorities are reducing their capital indebtedness per million cubic feet sold at a much greater rate than are the companies; and it is idle to ignore so patent a fact.

With regard to your demand for a further comparison, I am almost tempted to observe that, if you regard not the figures already given, neither will you be persuaded though others be supplied to you. As it happens, however, I did make such a comparison, although not based upon the method of selection which you suggest. My method was to take all the companies, numbering about 316, which are to be found in both the 1882 and the 1905 returns, and deduct the amount added for conversions, as recorded in the latest return. The result shows that the average capital outlay of these companies has been reduced from £731 to £599 per million cubic feet sold, which compares with the reduction during the same period by the local authorities from £712 to £401. Stated in another way, an increased consumption of 54½ thousand million cubic feet has involved an additional capital expenditure by these companies of 27¾ millions sterling, which is at the rate of £499 per million cubic feet sold, as compared with the additional indebtedness incurred by local authorities of only £188. I do not, of course, pledge myself to the absolute accuracy of these figures; but as to their substantial accuracy I have no reason to doubt.

There is but little difference in size between the two classes of undertakings which are thus compared, if measured by average consumption; but it may be observed incidentally that the later returns show the increase of consumption to have been the greatest with the undertakings owned by local authorities.

15, *Victoria Street, S.W., July 18, 1907.* CHAS. HUNT.

[It is to be hoped that Mr. Hunt is not continuing to give a mere "cursory glance" at what is said on this subject. But a little suspicion is entertained on the point, inasmuch as otherwise we do not think he would impute to us a disregard for the figures he has published. Those figures were fully understood by us. Our point applies not to the figures, but to the explanation; the complaint being that such figures were employed without *a full explanation* of the variations of condition that result in their widening as between companies and local authorities, apart from the conversion of capital by companies. We quite appreciate that Mr. Hunt would find it a tiresome undertaking to institute a comparison such as that we suggested last week; but it is the only fair way to compare like with like—that is to say (to put the point in fuller form than last week) a fair comparison with the 148 local authorities can only be made by taking 148 companies of approximately equal capacity and opportunity (eliminating the four London ones of 1882 and the three of to-day, and allowing for the conversion of capital); then showing what has happened in connection with those approximately comparable concerns. This process of selection would eliminate no less than 200 companies (excluding the London companies) whose capacity and opportunity are not comparable with the majority of the 148 local authorities, and whose inclusion in the comparison does not assist to make it look better from the companies' standpoint. If Mr. Hunt will compile such a comparison, we shall be pleased to publish it in full detail—both the 1882 and the 1905 figures—and show the result. Reserving to ourselves the right of judging of the selection made, we promise Mr. Hunt that we will be "persuaded" by the lessons that will

be produced as the result. Mr. Hunt says "there is but little difference between the two classes of undertakings which are thus compared, *if measured by the average consumption*." The italics are ours. Mr. Hunt is presumably trying to gain a point here by throwing the great weight of the London Gas Companies into the scale with all the little and highly capitalized companies per million cubic feet. Let us deduct the four London Companies of 1882 from the returns relating the 352 companies, and see whether the 348 remaining are equal in capacity and opportunity to the 148 local authority undertakings. Take coal first.

Coal Carbonized in 1882 *by Companies and Local Authorities.*

	Tons.
Total for 352 Companies	4,928,695
Deduct four London Companies (Field) .	2,054,409
Total for 348 Companies	2,874,286
Total for 148 Local Authorities	2,352,062
200 Companies	522,224

Therefore if 148 companies could be taken, carbonizing approximately the same quantity of coal as the 148 local authorities (2,352,062 tons), we have only 522,244 tons to distribute among the remaining 200 companies. And it is Mr. Hunt who, defending his figures as to capital per million, says there is "little difference in size between the two classes of undertakings," if measured by average consumption!

Consumption of Gas in 1882 *by Companies and Local Authorities.*

	Cubic Feet Thousands.
Total for 352 Companies	45,484,910
Deduct four London Companies (Field) . .	19,648,424
Total for 348 Companies	25,836,486
Total for 148 Local Authorities	21,129,034
200 Companies	4,707,452

The figures show that if 148 companies could be found with consumptions approximate to those of the 148 local authorities, then we have only 4,707,452 thousand cubic feet to distribute among the remaining 200 companies. It is Mr. Hunt who says there is "little difference between the two classes of undertakings!" Unfortunately, our file of returns is not complete for the earlier years of issue. But we find that in 1888 (deducting the three London Gas Companies) 392 companies had 10,763 miles of mains and 173 local authorities 7508 miles; but the 392 companies only had 807,667 consumers, the local authorities 1,089,748—that is to say, the 173 local authorities had 282,081 more consumers on 3255 miles less of mains than the 392 gas companies. This shows the great difference in the character of the districts supplied in favour of the local authorities. And all these points bear on the full explanation that we ask Mr. Hunt to make when such figures as those that he has recently been publicly using are produced.

Some Figures for 1905, *Excluding the London Companies.*

479 companies, coal carbonized	5,047,376 tons
270 local authorities, ,, ...	5,758,180 ,,
479 companies, gas consumption	64,700,766,000 cub. ft.
270 local authorities ,, ...	60,559,280,000 ,,

Does Mr. Hunt still say that there is but little difference in size (we would add, and condition) between the two classes of undertaking, when 479 companies are only doing about the same amount of business as 270 local authority undertakings? We repeat our claim that, when capital figures as produced by Mr. Hunt are used, particularly before men who are not gas experts, explanation should in fairness be made of the conditions that contribute to the large difference per million cubic feet of gas sold.—Ed. J.G.L.]

Distribution of Gas at Increased Pressure.

Sir,—What do these advocates of high-pressure mean? Mr. Carpenter's letter in this week's "Journal" is inexplicable. I understood him to say that he keeps the full pressure on during the twenty-four hours of every day; and yet he now states that he finds the greatest pressure necessary to be given throughout the week is on Sunday morning, and adds: "I think of this on winter Sundays, when I patiently (and shiveringly) wait until nightfall for the works to put the pressure on." Are we to understand now that at his works the pressure is taken off altogether on Sundays, and that Mr. Carpenter cannot even light his gas-stove till nightfall? Mr. Newbigging's "Golden Rule" neither advocates nor indirectly implies any such practice as that.

July 17, 1907. Student.

The Directors of the Walker and Wallsend Gas Company have declared the following interim dividends upon their stocks for the half year ended June 30: Upon the preference stock, at the rate of 5 per cent. per annum, less income-tax; upon the 3½ per cent. consolidated stock, at the rate of 4⅞ per cent. per annum; and upon the 5 per cent. ordinary stock, at the rate of 6⅞ per cent. per annum, less income-tax.

Rules for the Guidance of Workmen Employed in the Chief Inspector's Department of the Gaslight and Coke Company.

Sir,—At the recent meeting of the Institution of Gas Engineers, mention having been made of the rules which this Company issue to their fitters and other men employed in the Inspectors' Department, Mr. J. H. Brearley asked me whether the Company would publish those rules for the use of other undertakings that have not already their own printed rules, and might be desirous of drawing up a set applicable to their circumstances.

As this was followed by several requests from different quarters for copies of the rules in question, I referred the matter to the Governor of the Company. Mr. Corbet Woodall at once said that, if our rules were of any interest, or could be of assistance, to any of his colleagues in the gas industry, he was only too pleased for them to be published—only asking, in return, that if anyone should have any comments or suggestions to make concerning any of the rules, he should give the Company the benefit of his opinion and experience.

I accordingly have pleasure in enclosing a copy of the rules in question, and shall be glad if you will find space in your columns for them.

F. W. Goodenough.

Gaslight and Coke Company, Inspectors' Department, Horseferry Road, S.W., July 19, 1907.

[Enclosure.]

RULES FOR GUIDANCE OF WORKMEN EMPLOYED IN CHIEF INSPECTOR'S DEPARTMENT OF GASLIGHT & COKE COMPANY.

Special Note.

These rules should be read through, carefully noted, and kept for future reference by every workman in the department, as some instructions apply to all the men, while those which deal with any of the special branches of the department's work—such as stove-fixing, maintenance, and meter-reading—may at any time be of assistance to, and have to be carried out by, men not usually engaged on that particular work.

It is impossible for any book of rules to deal with every detail of every man's daily work; and these rules must be taken as dealing only with points to which it is deemed advisable specially to call attention. The omission of any express instruction to do, or not to do, anything which a workman having a reasonable knowledge of his trade, and possessing ordinary intelligence and commonsense, would do or would avoid doing, cannot be accepted as any excuse for failure on the part of any man to do his work in a proper and workmanlike manner, and to exercise foresight and judgment in the performance of his duty.

Ignorance of the following rules will not be accepted in any case as an excuse for failure to carry out any of those rules, which must be produced by every workman whenever an examination is made of his kit or at any other time if called upon to do so. The charge for a copy to replace one lost will be one shilling.

I have duly noted the above.

Signature of Workman.....

Date.....

Suggestions.

"Suggestion-boxes" are placed at every office; and suggestions towards improving the Company's system of working, or in respect of any matter which concerns the interests of the Company, are invited, and will be welcomed from any of the Company's employees. Intelligent criticism of existing methods, accompanied by proposals for their amendment—even if they are not accepted by those having, perhaps, fuller knowledge of the circumstances which govern the system of working—will be regarded as evidence of a man's ability and zeal.

Outdoor Workmen's Provident Society.

All workmen are eligible to become members of the Provident Society, provided they are certified as in good health by the Club Doctor, and are not over the age of 35 years. Every workman is strongly recommended to become a member; and a book containing all information and rules will be furnished to any man applying for the same at the office. The Company subscribe liberally to the Provident Society; and the allowance made to a workman injured in their employment is greater in the case of members than in that of non-members of the Society.

Rules.

I.—*General Conduct.*

Every servant of the Company shall conduct himself in a quiet and orderly manner at all times, be willing and obliging towards the Company's consumers, and adopt an invariable rule of courteously addressing all consumers, whether rich or poor, and so endeavouring to gain their appreciation.

Every man who respects himself will work for his employer as carefully, expeditiously, and economically as he would for himself. Every fitter is expected to see that his mate does a good day's work for his pay, and shows intelligence and willingness in the execution of his duty, and is expected to report faithfully to the foreman from time to time as to the value of such workman to the Company.

The Company subscribe liberally to their men's Provident Societies, give a week's holiday annually on full pay to permanent hands, and make good provision for their men when they are too old to work. They look, in return, for a conscientious regard for, and a zealous furtherance of, their interests on the part of all their employees.

Let every man realize—as, happily, most of the Company's men do realize—that the Company's prosperity depends upon the thorough satisfaction of their consumers, and that his prosperity depends on that of the Company. Men who do not realize and act upon these facts are not wanted. Men who do, will find the Company a good friend.

Promotion will always depend upon proved industry and steadiness, combined with ability and fitness for the service. Long service by itself does not entitle a man to promotion. Other things being equal,

the longer-service man will be preferred; but no man need expect advancement who has not made a real and persistent effort to fit himself for a higher position.

Every man should, by carefully studying the Company's pamphlets and other advertising matter—to be obtained in all the show-rooms—keep himself posted in all the arguments in favour of the use of gas for all purposes, so as to be able to answer questions put by consumers or intending consumers, and to take every opportunity of forwarding the Company's interests.

II.—*General Appearance, Cleanliness, &c.*

Every man must pay regard to his general appearance, and attend regularly and punctually at the office each morning with clean boots, and dressed in clothing suitable for his work and position, and endeavour to keep himself always smart, tidy, and clean. Observations are taken in this direction by the inspectors and chief officers, and are borne in mind when applications are received for increases in wages, or when selections are made for promotions to the staff.

III.—*Sobriety.*

The practice of drinking intoxicating liquors while on duty is strictly forbidden, and no man is allowed to enter (except on Company's business) or to loiter in public houses during the hours of employment. When engaged in work upon licensed premises, workmen should carefully avoid temptation to drink. Any complaints from consumers, or detection by the officers, of men being under the influence of drink on duty will be dealt with most severely.

IV.—*Smoking.*

Smoking is also strictly prohibited upon the Company's premises at any time, or on the districts while on duty.

V.—*Change of Address.*

Every workman must immediately notify the office of any change in his address.

VI.—*Absence through Illness, &c.*

When a workman is unable to attend to his duties through illness or any other cause, advice must be sent immediately to the office. If the absence extends beyond one day, a doctor's certificate must be forwarded.

VII.—*Caps.*

Every out-door workman is provided with an official numbered cap, which he is required to wear whenever on the Company's business. No man is permitted to begin work on any day unless he is wearing his official cap; and any man losing his cap will be suspended until it is found or the fact of its destruction proved to the satisfaction of the Chief Inspector. A new cap is provided for each man annually, in exchange for the old cap, which must be returned to stores in every case. Every man leaving the Company's service is required to give up his cap before he is paid the last amount of wages due to him.

VIII.—*Tools.*

Every workman is responsible to the Company for all tools, &c., entrusted to him, and is required to pay for the replacement of any tools missing whenever an examination is made of his kit. The value of any tools missing when a man leaves the service will be deducted from any wages due to him.

Pawning, or attempting to pawn, the Company's tools, renders the offender liable to prosecution as well as to summary dismissal.

IX.—*Escapes of Gas.*

Every man is required to display the utmost promptitude and activity in dealing with escapes of gas. Escapes must at all times take precedence over every other job; and any man failing to give immediate and adequate attention to escapes will render himself liable to summary dismissal.

Whenever a serious escape is suspected, all lights or fires in the vicinity must be immediately extinguished, the doors and windows of the premises thrown open, everyone on the premises warned against striking lights, and bystanders warned against smoking or using matches—the aid of the police being invoked, if necessary, to enforce this warning and to keep people away from the premises. Those summoned to attend to escapes must exercise their judgment as to whether all or any of these precautions should be observed; but care should always be taken to err rather on the side of caution than on the side of "chancing it," or under-estimating the possible danger.

Familiarity with the use and smell of gas should not be allowed to breed contempt in the minds of fitters for the risks attending its escape or misuse. Gas, like fire or electricity, is a dangerous thing out of its proper place, and those accustomed to dealing with it must never forget the fact, or neglect any proper precaution against accident.]

The Mains Department must be immediately communicated with when an escape is found or suspected to be coming from a main or service, or it is desirable to get the supply to any premises disconnected from without; the consumer being informed that it is necessary to summon the service-layers, and that the matter will receive the promptest possible attention.

It is the duty of everyone in this department at all times to co-operate in the fullest possible manner with the Mains Department in dealing with escapes, fires, or other emergencies connected with the supply.

In cases where gas has been, or is believed to have been, escaping, and it is possible that it may by any means have got behind a lath-and-plaster partition, under a floor, or anywhere whence it has no means of passing off to the free air, a light must not be used on any account, either for locating the escape (however trivial it may be thought to have been), or for trying work after the escape has been discovered and remedied, as gas has been known to remain inside partitions, &c., and to be fired by a light a long time after the escape has been stopped. In all such cases the fitter must rely on carefully smelling around the suspected part, in conjunction with the meter test—first making sure that the meter is sensitive enough to register a very small quantity of gas, and exchanging it if it is not. (*See* Rule XXXIII.)

No man should enter premises filled with gas without having first provided the means of getting out or being got out again quickly in case of need. This is best done by the man entering fastening to himself a rope, the end of which is retained by someone remaining outside, who should see that the man inside continues to signal to him from time to time in a pre-arranged manner. The neglect to take this precaution may at any time lead to fatal consequences.

Permission should be obtained from some responsible person before floor-boards are raised, or the structural portion of the premises is interfered with, in searching for an escape, unless, in case of urgency, no person is accessible from whom such permission can be obtained.

When searching for an escape complained of by a consumer, fitters should ascertain by examination and inquiry whether any section of the pipes is controlled by a master-tap, as, if there is an escape on such a section, it would, of course, only be noticeable if the master-tap of that section were turned on, and the escape would not show on the test dial of the meter or be detected in any other way if, when the search was in progress, the master-tap were shut off.

X.—*Using Matches or Other Naked Lights.*

Workmen must avoid the use of matches or other naked lights as far as possible; being particularly cautious should there be any smell or trace of gas or complaint of escape. Safety lamps must be used with care in such cases, and when exchanging or altering positions of large meters or working in confined spaces.

When it is thought safe to use matches or other naked lights, the greatest care must always be exercised.

When joints and fittings are about to be tried with lighted matches or tapers, the parts to be tried must be minutely examined, and the surroundings well fanned beforehand to prevent the possibility of a small collection of gas near the ceiling or in the roof of a vault, &c., being fired by the light; and afterwards a careful examination should be made for ignited escapes—the hand being placed on all parts of the joints and along the pipes with a view to detecting any small escapes that may have been ignited but only show a blue light. The whole of the pipes should then be fanned on all sides as a final precaution against the serious danger arising from the leaving of a blue flame burning.

The use of lighted rushes for joint making, &c., must be exercised with great care; no parts that may drop being left to smoulder. Spirit lamps should be used in preference to rushes. Matches must not be struck on woodwork or furniture. All ends of matches used must be brought off the premises.

XI.—*Escapes and Defects on Private Fittings.*

Any escape or defect found to proceed from consumers' fittings must be remedied or temporarily secured if it can be traced, and an explanation given to some responsible person on the premises. If the escape be of serious dimensions, and cannot be located and temporarily secured or remedied at the time, the gas should be turned off at the main cock, and an explanation given to the consumer, or some responsible person, that it is necessary to take such action for safety pending the arrival of consumer's own fitters, or further attention by the Company. All such cases should be fully and promptly reported on, in order that they may be dealt with by the Inspector.

If defects or escapes are reported by a consumer to a fitter employed upon other work, he must proceed to locate and secure permanently or temporarily (as may be possible) any escape, or to improve the supply if possible, informing the consumer as to the cause of the trouble. If an escape be found to be proceeding from the consumer's pipes which the fitter is unable to trace and remedy, the fitter must make out an "Escape" notice and deliver the same to the consumer or some responsible person on the premises, advising him to have the gas turned off if there is any reason to apprehend danger from the escape.

In the case of defects in private fittings (or in consumers' own stoves) which cannot be remedied there and then, the fitter must make out a "Defective Fittings" notice (with such alteration in wording as may be necessary in the case of defective stoves or fires), and deliver the same to the consumer, inquiring whether he will call in his own fitter or if he wishes the Company to deal with the matter right through. In the latter event, the fitter should, if possible, obtain the consumer's signature to the order form attached to the notice, and attach that order to his work-sheet. He must note and report all necessary particulars, especially drawing the attention of the foreman to the case should the consumer desire the Company to attend to the defects.

Before leaving the premises, the fitter should describe to the consumer the best means of temporarily stopping any further escape (should any be discovered), and the mode of ventilating the premises in such cases of escape.

XII.—*Working with Live Gas.**

In the event of any job involving work with live gas on services of 1 inch and upwards on the street side of the main-cock in any confined space—for example, where a connection has to be made on the service side of the meter and there is no means of shutting off the supply—an officer (or a workman specially selected for the purpose by the Inspector-in-Charge) must in all cases be present, in addition to the fitter and his mate, and any fitter commencing work on live gas contrary to this rule will be liable to summary dismissal.

This rule does not apply to the work of taking out the plug of a main-cock to ease it, of capping a service, or of examining capped services or tees.

XIII.—*Persons Suffering from Effects of Gas Poisoning.*

As long as the person affected has not lost consciousness, there is little cause for alarm; but a doctor should be summoned if the ordinary measures do not bring about prompt recovery. The sufferer should be removed immediately from the influence of the gas, be given plenty of fresh air, and, if able to move at all, be kept walking about, as the exercise helps the respiration. He (or she) should be given plenty of milk, or milk and soda, or water in which baking-soda has been dissolved (a teaspoonful to the pint). Strong salts of ammonia held under the nose will help to revive the sufferer.

If the victim has lost consciousness, a doctor must immediately be sent for, the sufferer laid on his back, with a tightly-rolled coat under the shoulders to throw the head well back, and the following pro-

* See Rule LV. as to avoiding work with live gas in case of new unvalved services.

cedure adopted until the doctor arrives, when, of course, his instructions must be carried out.

Open the clothes at the throat, chest, and abdomen. Roll up the trousers from the legs. Supply heat to the extremities, either by vigorous friction or by hot bricks, hot-water bottles, plates, &c. Pull the tongue out of the mouth, and hold it firmly to prevent it slipping back and falling into the throat. Make the victim breathe by kneeling at his head, grasping his arms at the elbows, and pressing them vigorously to his sides; then straighten the arms, pulling them back until the hands meet over the head; then return the arms to the sides and fold them across the chest, pressing them down hard. Repeat about four or five times a minute; being careful not to make the motions too rapidly. The sole object of the motions is to fill the lungs with air and empty them in imitation of natural breathing.

During the entire process of artificial respiration let others apply heat to the extremities, either by friction or by hot-water bottles, bricks, plates, &c., and slap the chest with a wet towel.

The restoration of asphyxiated persons has been accomplished at long periods after apparent death, so artificial respiration should be continued until a doctor pronounces the victim dead.

The work, to be effective, is very tiresome, and ten minutes at a stretch is about as long as one man can administer the treatment effectively. On this account, operators should be changed before their strength is spent.

When the victim begins to breathe naturally, give him a dose of aromatic spirits of ammonia—*i.e.*, sal volatile—and cover him up warmly until he can be moved.

XIV.—*Fires, Explosions, or other Accidents.*

In all cases of fires, explosions, or other accidents reported at the office, an officer should accompany the fitters (if the District Inspector be out, he must follow immediately upon receiving the report), and the greatest care and promptitude must be exercised in shutting off the supply at the main-cock (or valve outside the premises, if one exists). Where this course is not possible, the service-layers should be summoned to open the ground outside and disconnect at the main (if found necessary) or in the footway.

Should any case of fire, explosion, or other accident be brought to the notice of any workman when on the district, or he be called upon for assistance, the course above indicated must be adopted; care being taken always not to disturb unnecessarily or to remove any fittings, pending the visit of the insurance authorities. Should a fire, explosion, or other accident occur when the Company's men are at work on any premises (whether due to their work or not) the foregoing instructions must be strictly observed, and report immediately made to the office.

XV.—*Mishaps or Damage when at Work.*

Should any mishap or accident of any kind happen while the Company's men are working on premises which is a consequence of their so working—for instance, injury to ceilings, breakage of, or damage to, furniture, goods, &c., fires, or explosions—the men must do all they possibly can to repair the damage for the time being, carefully clear up, assure the consumers of immediate attention from the Company, and report at once fully to the foreman and inspector.

Should any person be injured as a result of such accident, prompt attention must be given, and if the injury be serious, a doctor must immediately be summoned, the injured person be properly cared for, and, in very serious cases, the relatives be notified.

Reports of accidents must always be made in writing, be made as soon as possible, and should contain the fullest possible particulars, including the date and precise time of the accident; the full names and addresses of any witnesses of the accident; any comments made by such witnesses; the cause of the accident, as nearly as it can be determined (care being taken to state that the cause is "surmised to be," if any doubt exists), with an explanatory sketch, if possible; the full name and address of any person injured, with nature of injury; the name and address of the doctor called in, if any; and the address to which the injured party has been taken.

Every accident which may occur in the course of a man's work, whether to himself, to property, or to other people, must be promptly and fully reported, however trivial or insignificant it may appear to be. Disregard of this rule will be very seriously regarded. A special warning may be given against the temptation to suppress or minimize any circumstances connected with the accident, as, however much the facts may reflect upon any of the men concerned, the consequences to those who may be to blame will be much less serious if those facts are promptly and frankly reported than if they are held back and are subsequently discovered. Mistakes can, but deceit cannot, be pardoned.

XVI.—*Equipment on Leaving Office.*

Before leaving the office for the day's work, every fitter must see that he is duly provided with all the tools, materials, &c., that he will require for the carrying out of the whole of his day's work, so as to avoid all chance of wasting his own time and that of his mate by having to send back during the day for missing tools, &c., causing at the same time annoyance to the consumer and damage to the Company's reputation as a business firm.

XVII.—*Appointments—Punctuality.*

Whenever an appointment is made for men to attend at a consumer's premises at a definite time, every effort must be made to keep the appointment punctually. If anything altogether unavoidable prevents the appointment being kept punctually, a message should be sent by the fitter's mate or other available messenger to the premises expressing regret for the delay and stating the time at which the men will be able to attend. Every appointment made by a workman with a consumer for his own or anyone else's attendance on a future occasion must be carefully and exactly noted in his pocket work-book and on his work-sheet.

XVIII.—*Admission to Premises.*

Every servant of the Company should guard against entering private premises without first ringing or knocking for the purpose of obtaining permission to enter, even though doors may be found open; but in regard to open business establishments, this procedure is not always necessary.

Upon obtaining admission, the workman should clearly state the object of his call, and courteously endeaver to convince the occupiers as to his *bona-fides*, if any doubt exists.

If admission cannot be obtained (in answer to a complaint or request to call), another call should be made (if possible the same day); and if with similar result, a full entry must be made in the pocket work-book and on work-sheet, for the foreman's attention during the evening; and the latter must report specially to the Inspector in case the complaint be of an urgent character. If the fitter cannot obtain admission at premises respecting which a serious complaint of escape has been received, he should return at once to the office to report.

If escaping gas is found to be coming from a vacant house, the police should be summoned with a view to an entrance being effected. No Company's workmen must ever force an entrance into closed premises, except in cases of extreme urgency.

XIX.—*Trucks Left Unattended.*

It is frequently necessary to leave trucks outside premises when the work inside necessitates the attendance of fitter and mate.

In such cases the greatest care must be exercised to avoid loss of tools,* material, stove utensils, &c., which (unless locked up in the truck box) should be, as far as possible, removed to a place of safety.

In the City, in districts where traffic is heavy, and when trucks are practically empty, it is often possible to arrange to leave trucks, for the time being, in suitable places—in mews, yards, &c.—by first obtaining the necessary permission.

XX.—*Condition and Use of Trucks.*

The greatest care must at all times be taken with trucks. They should not be taken out in a dirty condition, or in a bad state of repair. Workmen are forbidden to push trucks from the wrong end with handle uplifted, as the control over the truck is thereby considerably lessened, and a greater risk is run of colliding with other vehicles should the truck become involved in congested traffic.

Should an accident occur and injury to person or property result owing to this order being disregarded, the offender will be dealt with severely.

XXI.—*Ferocious Dogs Kept.*

Note must be made—by the fitters in pocket work-books and on work-sheets (for transfer by clerk into meter-index book), and by index-readers in meter-index books (in red ink)—where it is found that ferocious dogs are kept. Care must be taken when at work with fittings disconnected, or gas on, if such dogs are allowed to remain unchained.

XXII.—*Conversation with Servants and Others.*

All men are especially reminded that they are not to converse unnecessarily with consumers, members of the household, or servants; are not to make inquiries outside those necessary in connection with their work; and are not to make any comments, favourable or otherwise, on a consumer's gas appliances, nor to criticize to the consumer or his servants work done by other workmen.

XXIII.—*Questions from Consumers and Others, outside the Business of Fitters.*

Any questions or inquiries from consumers, which the fitters are not able—or which they do not think it advisable—to answer, being in reference to matters outside the actual business or knowledge of the fitters, should be carefully noted and reported to the foreman for the attention of the Inspector; the consumer being courteously informed that his inquiry will receive attention at the earliest possible moment.

XXIV.—*Requirements and Requests of Consumers.*

Fitters are frequently asked for utensils for stoves, and for burners, rings, tubes, &c., or receive applications for the supply of cookers, fires, fittings, lamps, &c. All such requests must be carefully and fully noted in pocket work-book, and reported on work-sheet for the attention of the foreman and Inspector. No complaints should be received by the Company of promises of attention having been made by the Company's men and not fulfilled.

XXV.—*Assistance Rendered by Consumers.*

If any man, in the course of his work, has occasion to ask an accommodation from a consumer or his servants—for example, the loan of steps, a supply of water, &c.—he should never omit to express thanks for the favour, however small.

XXVI.—*Private Work for Consumers.*

No servant of the Company is allowed to undertake work on his own account for any of the Company's consumers at any time, and no charges are to be made under any circumstances by workmen to consumers for any work executed. Any work in connection with private fittings, stoves, &c., required by consumers to be done (if not small jobs that can be done straight away—such as repacking a gas-fire—particulars of which should be duly booked) must be dealt with in the same way as "defects in private fittings," as to which see Rule XI.

XXVII.—*Attention of Consumers to be drawn to Cash or Jewellery Exposed.*

It is important that, should any workman discover any jewellery, cash, or other valuables exposed to view in any room where he is called upon to work, the attention of the consumer or his servants should at once be drawn to such valuables, and that the greatest care should be taken by the fitters and their assistants to make a complete note in the pocket work-book of any property found so exposed, with particulars stating whose attention was drawn thereto, with time and date; and if the valuables are not removed during their attendance, the course above indicated should be repeated before leaving the rooms or premises.

Strict attention to this rule is enjoined in the interests of the workmen themselves.

XXVIII.—*Abusive or Ill-Tempered Consumers.*

Occasionally the Company's workmen have to deal with consumers inclined to be unreasonable, ill-tempered, or even abusive, especially in cases of disconnection of supply for non-payment. Particular care must always be taken to show every possible courtesy and forbearance towards such consumers, and to avoid loss of temper, the display of any personal feeling, or the resentment of abuse, which, it should be remembered, only reflects upon him who resorts to its use.

* See Rule VIII.

Where it is found that a consumer has, without apparent reason, a grievance or prejudice against the Company, courtesy and discretion on the part of their servants may often discover, and secure the removal of the cause of, such grievance or prejudice. In any discussion with a consumer, speaking loudly or excitably should always be avoided. A quiet, confident, and respectful manner carries more weight than any amount of bluster, which only irritates and offends.

XXIX.—*Condition of Company's Services.*

Every employee should take every opportunity of observing the condition of the Company's services and meters, and, if defective, book and report same for attention.

Every opportunity should also be taken of making sure that gas is not being obtained without being metered. Wherever any suspicions are aroused on this point, the workman first noticing the suspicious circumstances must carefully and exactly note, and quietly bring to the notice of any other Company's men working on the premises, all details of the apparently fraudulent connection, say nothing to anyone else on the premises, and secure the presence of an officer at the earliest possible moment.

Meter-index readers must constantly bear this instruction in mind.

XXX.—*Condition of Stoves and Fires in Use.—Repairs to Stoves in Situ.*

When attending premises where cooking-stoves or gas-fires are in use, fitters must note the condition of same; and, where it is seen to be needed and such a course is possible, courteously explain the proper uses of such stoves and fires and the method of using them. All defective parts must be noted, and (if on hire) booked for exchange, including the stoves themselves if beyond repair; or, in the case of private stoves, reported for attention by the foreman and Inspector.

Fitters must not, however, book hired stoves for exchange unless that course is absolutely necessary; it being far cheaper for the Company to repair stoves *in situ* than to incur the expense entailed in effecting an exchange and renovating the old stove at the works. Every stove booked for exchange by a fitter will be inspected either by an officer or by the foreman before the order for a new stove is given; and any tendency on the part of fitters to save themselves trouble by the unnecessary exchanging of stoves will be dealt with severely.

In effecting repairs to stoves and fires *in situ*, the instructions given in Rule LI. respecting the fixing of stoves and fires must be carefully observed, as far as applicable; and attention is here specially drawn to the injunction to fitters to make certain that every stove with which they have to deal is left in perfect working order in every particular. To discover and remedy one defect in a stove respecting which a complaint has been received is not sufficient; the stove must be thoroughly examined and tested to make sure that it is in good order in every other respect.

Oven-Burners Smothering Out.

When a cooking-stove is found to be suffering from the defect of "oven-burners smothering out," the following instructions must be carefully observed.

In every case the stove and the supply to the oven should first be disconnected, and the whole of the flue-pipes, if any, should be taken down and thoroughly cleared, if necessary.

All grease, &c., must be cleaned off the sides of the oven, as grease has a tendency to smoke and burn when the oven is hot, and so helps to smother the lights out.

In the case of stoves which are ventilated through a chamber between the oven and the crown-plate—which is the case with all except Davis cookers—the top of the stove must be removed, and the ventilating chamber thoroughly cleaned out.

The oven-burners must in all cases be removed and thoroughly cleared of all grease, carbon, dirt, &c., as must also the air-chamber. In refixing them, care must be taken to see that the nipples are properly adjusted to give a good bunsen flame, and that they play into the centre of the burners, as if the gas is allowed to strike the side of the burner it is liable to fire-back. Lighting the jet at the air-chamber for a moment will show at once whether the nipple is properly centred.

Care must be taken to see that the drip-tin fits properly, and that there is not a strong draught from a door or window interfering with the proper burning of the gas in the oven. (See Rule LI. as to the best way of dealing with undue draught.)

It is equally necessary to see that sufficient air enters the bottom of the stove to support combustion, and that the consumer is not using a baking-tin so large as to be practically of equal area to that of the oven. If such be found to be the case, the consumer should be politely advised to use a smaller size.

A strong spindle screwdriver is the best kind to use for taking stoves to pieces, as broad screwdrivers cannot always be turned between the fittings on the hot-plate, &c.

A cross cut is useful for starting screws.

All parts must be carefully refixed, and the stove tested and left in proper working order in every particular before any job is answered off as completed.

XXXI.—*Condition of Incandescent Burners in Use.*

When attending premises where incandescent gas-burners are in use, fitters must, as far as opportunities permit, note the condition of the mantles, &c.; and if that condition is not satisfactory, the fact must be noted and reported on the work-sheet.

XXXII.—*Obsolete and Defective Fittings, Burners, &c.*

Where it is evident that complaints of bad light are due to the use of old-fashioned, inefficient, or defective fittings and burners, or to the meter, meter fittings, or carcase pipes being too small, or badly run and connected, the facts must be courteously explained, and advice—coupled with an offer on the part of the Company to carry out any necessary work at cost price—must be given to the consumer by the fitter, who must fully report such cases for the attention of the foreman and inspector.

XXXIII.—*Shutting-off and Re-Connecting Supply: Examinations and Testing.*

When it is found necessary to shut off any supply or supplies, the fitter must first request some responsible person upon the premises to see whether all lights, stoves, or other apparatus are turned off, and to have that done if any are burning. After such person has examined the premises and stated that no gas is in use anywhere, the fitter must watch the test-dial of the meter, and then try it with one small light in use, to determine whether the meter will register at this point. Should the meter be found not to register with one burner alight, a gauge should be fixed to the first available point which is near the meter outlet. The pressure should then be noted with the main-cock on and no gas, according to information, being used. The main-cock should then be shut off and the gauge watched. If no gas is actually being consumed, and there is no escape, the pressure will remain constant at the point at which it stood when the main-cock was open; whereas if gas is being burnt or is escaping anywhere, the pressure will fall at the gauge, and the cause must be sought and dealt with at once. Where any rooms are closed, and it is uncertain if gas is on or off in such rooms, disconnection should not be made until access thereto has been obtained.

When the fitter is satisfied that all is safely shut off, he may proceed with the work of disconnection. When reconnecting, the gas should be turned on and used until the pipes are clear of any air; this course being followed by watching the test-dial finally for any leakage, and examining and testing work and fittings. Care must be taken to see that the bye-passes of any incandescent burners in use in any part of the premises are re-lighted after the supply is restored.

XXXIV.—*Using Pumps.—Ascertaining the Run of Services, &c.*

Before using a service-pump, the fitter must first find the entrance of the service into the premises, examine the run of the supplies, and the T's in the service, and note the number of meters connected to the service, or to the T's therefrom; the greatest care being exercised when using the pump not to put any charge through a service or riser with such connections unless at a point where the service enters the premises from the roadway—the charge being, of course, blown into the main—or unless, in the case of teed services or rising mains, all cocks on inlets of meters have been carefully noted and turned off. Complete examinations and testings must be made of all supplies following such operations, before leaving the premises.

When it is necessary to use a pump on a supply taken from near the dead-end of a service or small main, the fitter must request the consumers taking supplies from such service or main between its dead-end and the point at which the pump has to be used to allow him to shut off their main-cocks temporarily; warning them of the possible danger of the charge from the pump taking effect upon their fittings (and especially on watered chandeliers) if they refuse. The fitter must subsequently see that the supply is restored in all cases, and that everything is left in safe and proper order in connection with all the supplies affected.

Old piping should not be hammered to loosen scale or rust, as it is not possible to judge what harm may be done by such hammering in other directions. Tapping services to dislodge naphthalene should be done with great care, and with as little violence as possible.

XXXV.—*Handling and Fixing Meters.*

Meters contain a good deal of mechanism, and must at all times be handled carefully. They should always be kept upright, and never be jarred or bumped on the ground or banged on the bottom of a truck. They must, in fact, be regarded and treated rather as if they were clocks than as if they were merely tin boxes.

Meters must always be fixed in dry places, properly supported, set level and plumb, with no part of the case touching any metal, cement, brick or stonework, and, as far as possible, where they will not be exposed to unusual heat or to serious fluctuations in temperature, and be easy of access for reading. Lead meter-connections must never be kinked or flattened.

XXXVI.—*Leaky Meters—Temporarily Securing, and Exchanging.*

When meters are found to be leaky, the usual and recognized means must be adopted for temporarily stopping the escape of gas, if possible; but the exchange of the meter must in all cases promptly follow. Where the leakage is such that it cannot be safely secured temporarily, the gas should be shut off and a new meter or temporary connection obtained and fixed at once; explanation and warning being clearly given to the consumer to avoid any accident by the use of lights near to the meter in the meantime.

Whenever meters are found to be leaking, care should be taken to note whether there are any local conditions likely to have caused, and to continue to cause, damage to a meter, such as leakage of acid from batteries, of current from wires, &c.; and any such harmful conditions should be reported immediately, so that steps may be taken by the inspector to get the position of the meter changed or the cause of damage removed.

XXXVII.—*Exchanging Meters.*

When exchanging meters at places of worship, halls, clubs, hotels, or large business houses (especially where the meter-fittings are complicated or governors are in use), it is necessary that the connections and supplies generally should be examined before dusk on the day on which the work has been done, to make sure that everything is in proper order before lighting-up time.

The foremen, in conjunction with the inspectors, must pay special attention to this rule, and make personal examinations in the cases referred to whenever possible—arranging for the examination to be made by their deputies if prevented by other important and urgent business from attending themselves.

XXXVIII.—*Liquor from Meters or Fittings Disconnected.*

All possible care must be taken, when exchanging meters or disconnecting pipes, to avoid the dropping of any gas liquor; and should it so happen that any be spilt, the attention of the consumers should at once be drawn to the fact—the fitter washing the parts affected, and procuring a disinfectant if possible. No liquor may be poured down drains, inside or outside premises.

XXXIX.—*Total Failure of Supply.—Temporary Connections.*

Where it is found that a meter has ceased to pass gas, a new meter must be obtained at once and fixed. In the event of no meter of the right size being in stock, and in the case of night complaints of this character, temporary connections may be fixed; and fitters attending

to such night defects should request the night watchman or inspector on night duty to refer to the meter-index book, so that they may obtain the proper sized connection before going to the job. Many letters or messages of complaint give information pointing to the probability of a meter having failed, when they state "Gas has suddenly failed," or "Gas has gone out," &c.; and this should be a guidance to those attending, either to take a new meter or a temporary connection. All cases of failure of supply should have the very promptest attention in the manner above described.

Fitters are forbidden to shake stopped meters, or in any other way endeavour to make them pass gas again.

XL.—*Meter-Index Reading—Marking Cards.*

Meter-indices should always be read a second time and deductions made carefully; the entries and deductions on the cards and in the meter-books being made independently and then compared. All entries must be made in ink; no erasures are permitted, either in meter-books or on cards; and if cards are not obtainable, entries must be made on query sheets provided for this purpose inside the meter-index books, under the headings of "Card not marked," "New card required," or "New card left," as the case may be.

Meter-readers must always carry a supply of cards, to assist them in this work, and save time and journeys, but must not leave a new card unless the consumer states that the card has been lost and not merely mislaid.

XLI.—*Fluctuations in Consumption: Questioning Servants and Others.*

When the recorded consumption is small, as compared with the corresponding quarterly, monthly, or weekly reading, it is necessary to ascertain the reasons as accurately as possible. The cause of decrease may be obvious from alterations made, stoves or engines removed, &c.; and it must be borne in mind that direct questioning of servants and others must be avoided if possible. But by the exercise of care, courtesy, and discretion, reliable and useful information may often be obtained, and should be recorded in full on the query sheets attached to meter-index books.

When the consumption has increased, the greatest care should, likewise, be taken in reading and examining the index a second or third time. There may be good reasons shown in the meter-index books for such increases—viz, additional lights, additional or larger stoves, &c. The asking of questions should be avoided; but care must be taken to see that the consumptions are correctly recorded. In case of very extraordinary increases in consumption, for which no apparent reason can be discovered, the case should be noted and specially reported to the Inspector, who will then make further examination and inquiry.

XLII.—*Testing Meter for Unregistered Gas.*

When the consumption is found to be very small, or considerably decreased without good and obvious reasons, the meter-reader should courteously ask for all lights to be turned out, if gas is in use—always provided it is convenient then to the consumer. The test-dial should then be watched with one burner lighted, to see whether the meter has stopped registering or is passing a percentage of unregistered gas, and the result should be entered on the query sheet or in the query book, giving the folio of the meter-index book, thus: "Folio 168: Will not register with one light," or "Registers with one light," as the case may be.

XLIII.—*Noting Electric Light in Use, Gas-Engines, &c.*

Care must be taken by index-takers to see that, in all cases where electric light is in use, a note of the fact appears in the meter-index books. Gas-engines in use must also be noted, and, if not already entered in the meter-book, particulars of maker and size (B.H.P.) must be reported on the query sheet.

XLIV.—*Cutting-Off and Change of Tenancy States.*

Fitters sent to disconnect a meter or to record a change of tenancy index must carefully mark the card, and, whenever possible, obtain the new address of the outgoing tenant, entering the same in the pocket work-book and on the work sheet.

If the supply is capped, the proper label must be attached to the capped service; and the inlet of the meter (and the outlet in case of complete disconnection) must be corked.

If gas should be required by the incoming tenant, the fitter should defer disconnecting and report full particulars for the Inspector's attention.

XLV.—*Meters and Stoves not to be Removed if Premises are to be Shortly Occupied.*

To save unnecessary trouble and expense, full inquiries should be made by fitters sent to cut off and remove meters and stoves, who should note the condition of same, and ascertain, as far as possible, to whom the premises are let and the probable date of the new tenant taking possession. If there be any reason to expect that the gas will be required again within a reasonable time, the meters and stoves should be left, and a report made at once for the Inspector's attention.

XLVI.—*Private Fittings not to be Removed from Premises.*

No private fittings—such as, in the case of ordinary supplies, main-cocks, unions, lead pipes, brackets, pendants, burners, &c.—are to be removed; and a note must be made in the pocket work-book and on the work sheet, at the time of removing meters, that all fittings have been left upon the premises. Stove-fittings (ordinary), including base-stones, belong to the consumer, being either supplied and fixed by private fitters or, if fixed by the Company, paid for by the consumer.

XLVII.—*Care in Cutting Away: Avoiding Damage to Property.*

When fixing cookers, fires, lamps, fittings, &c., the greatest care must be taken not to do any more cutting away than is absolutely necessary, and all must be carefully and properly made good, or booked for further attention if required. All possible care must be taken when carrying out fixing work to ensure neatness, cleanliness, and safety in working; any soiling of carpets, furniture, wall-paper, ceilings, walls, &c., by dirty boots, grease, oil, use of tools, or other means, being carefully avoided. Covers for floors, furniture, &c., can, and should always, be obtained from consumers by a courteous request. In cases where it is necessary to work on parquet or other polished-wood flooring, the fitters during all the time they are at work should wear felt slippers, which are provided for the purpose by the Company.

XLVIII.—*Fixing Vices on Woodwork, Furniture, &c.*

Vices must not be made fast to furniture or woodwork of premises, except in cases where no appreciable damage would be caused, and then only with the express permission of the consumer. Whenever a truck is available, it must be used when cutting and screwing barrel, &c.

XLIX.—*At Work with Flooring Up.*

When it is necessary to take up flooring, all care must be taken in replacing and securing the boards temporarily (or properly guarding the opening) if the job has to be left, and the attention of occupiers must be drawn to the circumstances. No carpet, linoleum, or other floorcloth should be left turned back in such a way that it may fall and cover an opening. No opening must be left unprotected at any time, whether work be in progress or otherwise; and flooring should be replaced (screws being always used and fillets put on the sides of the joists for the boards to rest on), and everything made good and secure, as quickly as possible.

L.—*Fixing Outside Lamps.*

Outside lamps must be carefully secured by safety chains or clips, and must only be fixed at heights allowed by the local authorities. Fitters must see they are provided with the necessary information as to the required height above pavement level before commencing the work. Special care must be exercised to avoid any accident or damage to facias, plate-glass windows, &c., during the execution of this class of work. Brackets for outside lamps should, whenever possible, be fixed firmly on to the building, not to blind-cases or other insecure hold. All cups-and-balls, sockets, connections, &c., should, wherever practicable, be kept fixed in position by set-screws.

LI.—*Fixing Stoves.*

Every fitter must regard it as of the utmost importance to see that every gas-stove fixed is fitted in the neatest and most workmanlike manner, causing—in the case of gas-fires—the least possible disfigurement of the fire-place, and having careful regard to the style and ornamentation of that fire-place and its surroundings. The supply to every fire should be as unobtrusive in appearance as possible.

Every fitter must also regard it as his bounden duty to see that every stove is left in perfect working order, so that he can feel sure that the stove, if properly used, will not only give rise to no complaints, but will always give the best possible result. It must be borne in mind that very many consumers do not know the full possibilities of a suitable gas-fire well-fixed, and would therefore, in the event of a fire not working in every way successfully, regard the result as the best obtainable, and look upon gas-fires as not altogether satisfactory—in ignorance of the fact that if a more suitable stove had been fixed, or if the one selected had been more carefully fitted, they would have obtained far more satisfactory results.

If, after doing everything he can to get a stove to work to his complete satisfaction, the fitter is still not satisfied, he should at once report the fact to his foreman, so that the trouble may be carefully investigated and put right—by the exchange of the stove, by taking special measures to overcome down-draught, or by whatever means may be found necessary. It must never be a case of "I think that will do"—it must always be "I am sure that is all right."

Special attention must be given to the following points in carrying out the work of fixing:—

Heating Stoves with Flue-Pipes.—(1) Every stove must, if possible, be fitted with elbow and length of flue-pipe, which must be tested to make sure that it is in sound condition, and be carefully fitted, so that all fumes are carried up the chimney. Wherever possible, the flue-pipe should reach beyond the register of the grate. This acts as a safeguard against the register falling and preventing fumes from passing up the chimney. In any case where a length of flue-pipe cannot be used, the fitters should see that the register of the grate is securely opened. All flue-outlets should be drilled and a set-screw used, wherever possible, to fasten the flue-pipe to the outlet.

(2) Before fixing any stove, it is necessary thoroughly to test the draught in the chimney by means of a lighted taper. Should the up-draught be too great, a false register must be fitted, or the grate opening be closed by sheet iron—in each case with a flue-pipe passed through it—and the size of the flue-pipe reduced and a cone fixed on it to check the up-draught.

(3) Should a down-draught exist, or be feared, a Barker's eduction valve should be fitted on the flue-pipe of the same diameter, and a false register fixed as before. The fixing of a sheet-iron cap over the chimney pot with a length of flue-pipe running through the cap—projecting 2 feet into the chimney and 2 feet above the cap, with a cone fitted on the top, may be found necessary and sufficient in the case of a severe down-draught, or a sluggish chimney. Further, the consumer should be informed that, should the steps taken not prove sufficient to remedy the down-draught, a reliable cowl must be fixed on the chimney. This information should, however, be conveyed to the consumer by the Inspector, who should be informed, through the foreman, of every case in which any difficulty arises in getting stoves to work satisfactorily.

(4) If the draught be sluggish so that the whole of the fumes are not properly carried up the chimney (which should be tested by holding a lighted taper at the top of the fire-opening of the stove, with a view to seeing whether any gases issue from the top of the fire-opening instead of the flame of the taper being slightly drawn into that opening) a further length of flue-pipe should be added to that already fixed, and a false register fitted, if necessary.

(5) Ball fuel should be packed lightly and in such a manner as to keep it as far as possible away from contact with the flames, and so as to enable the flames to play through the holes in the fuel rather than against the solid portion of it. Whenever possible, oblong fuel with open ends should be placed end-up in the first two rows above the burners, one piece directly above the other, so as to allow free play of the flames through the fuel. The rows above should be laid horizontally so as to catch the heat. Care must be taken to see that no fuel broken small is left in the fire, and also that there is a proper

quantity (not an excess) of fuel to make full use of the heating power of the flames.

(6) The fitter must see that the burners are thoroughly clean and free from roughness in the casting; that the injector is fitted and adjusted truly so that all the gas flows directly into the burner and that none escapes on either side of the air chamber; that the injector is thoroughly clean; that the flames in the burners are equal; that a proper mixture of air and gas takes place; and that the fire burns silently. If the mixture be not correct, the injector should be very slightly opened or closed, or, in the case of fires fitted with an air or gas regulator, such regulator should be adjusted so as to give the proper flame. A very slight adjustment of the injector makes a considerable difference in the mixture. In opening out an injector, each hole should be very slightly broached out by means of a special broach; the plan of considerably broaching out only one or two of several holes must not be adopted. The injector must be changed if a good result cannot otherwise be obtained.

(7) Care must be taken to see that the stove is set firmly in its place and is on the level, and that no rubbish is left in the grate behind. Consumers should be politely cautioned against throwing matches, cigarette ends, &c., into the fire.

(8) The fitter should see that the stove is large enough to heat the room, and, if it is not, report the fact, so that the Inspector may take the matter up with the consumer.

(9) The top of the stove should be examined carefully to see that the radiating chamber is sound and that no fumes can escape therefrom; the stove being exchanged if defective.

(10) Care should be taken to see that the supply of gas is sufficient. If the supply is inadequate, it is necessary first to make sure that there is no dirt or stoppage in the cock. If everything is found in order, and the deficient supply is found to be due to too small a supply-pipe, the circumstances must be reported and the Inspector's instructions awaited.

(11) The plugs of cocks should not be allowed to grind on the hearth or floor board.

(12) In fixing a governor it is necessary to see: That the barrel and fittings are thoroughly free from dirt, filings, &c.; that the gas-way of the cock is free from grease, sand, or other obstruction; that no dirt has gone into the governor, and that it is properly in action; and that the governor is fixed between the cock and the fire, with the inlet side to supply.

The governors sent out for each fire are adjusted to give the proper quantity of gas required for the efficient working of that fire. If, however, at any time, the governor is found to give too much gas, the small iron screw at the side should be slightly screwed in, and the reverse if there is not sufficient gas on the outlet while plenty on the inlet of the governor. The supply should not be increased, however, unless it be found to be insufficient after the fire has been alight some little time.

If a governor should at any time require cleaning, this can be done (without disconnecting the governor) by unscrewing the plate on the top, and taking out the valve by means of a piece of rolled paper inserted in the tube to lift it out. The cylinder and centre hole in which the valve works should then be wiped with clean rag on a piece of wire of suitable size. The tube and outer edge of the valve should then be wiped and replaced in the cylinder and the plate screwed on; a little firm grease being used on the screw—so rendering it easier to unscrew again when necessary. The whole operation should not take more than five minutes.

(13) Woodwork in the vicinity of a stove must always be carefully protected, by sheet iron or asbestos, from any risk of scorching or being fired.

(14) The proper way to light the stove should be explained to the consumer and to his servants; the stove being shown both lighted-back and lighted properly.

Gas-Fires in Grates.—Rules Nos. 5, 6, 8, 10, 11, 12, and 14 are to be observed.

(15) Where a gas-fire is about to be fixed in a grate, the consumer should be advised to have the chimney swept before the work is commenced, to avoid trouble arising out of soot afterwards falling on the asbestos.

(16) In cases where there appears to be an excessive draught up the chimney, a false register should be fitted, with an aperture cut therein fully sufficient to allow the products of combustion to escape up the chimney. The partial closing of the existing register, wedged up to keep it partially open, should not be relied upon.

(17) In case of a down-draught, the consumer should be advised to fix a cowl on the chimney, and the fixing of the fire should not be proceeded with until the Inspector has been informed of the fact and has received the consumer's instructions.

(18) The fire-brick or fire-clay in the grate should be properly set and well forward. The latter is most essential in order that the heat may be deflected into the room instead of wasted up the chimney.

Condensing and Syphon Stoves.—Rules Nos. 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14 are to be observed.

(19) Fitters must see that the condensing tubes are clear, and that the flames do not come outside the stove, as this causes an offensive smell, and has often been a source of trouble.

(20) The joints of tubes must be examined where they are fitted into the frame of the stove, to make sure that there is no escape of fumes through leaky joints.

Cooking-Stoves.—(21) Fitters must see that all utensils usually supplied with the stove have been delivered and are in proper condition.

(22) All burners, injectors, air-chambers, deflectors, and oven ventilators should be examined carefully and adjusted where necessary.

(23) Fitters should ease or grind-in any taps that require attention, and see that none of the taps are too loose. This point must receive careful attention.

(24) Care must be taken not to fix the stove in a draughty place, either by a back door or between a door and window, or where there is a strong ground draught. If this cannot be avoided, it is advisable to fix an L-shaped piece of sheet iron under the base-stone on the side affected by the draught, to act as a wind-guard; but the foreman should be specially consulted in all such cases. A strong current of air blowing through a stove not only prevents the oven getting hot, but meat, cakes, pastry, &c., are spoiled in the cooking, and take twice as long to bake as they would with proper heat.

(25) A draughty scullery is not at all the best place for a gas-cooker, and consumers should always be advised to have cookers fixed in their kitchens; and then, for preference, not in any recess, where they cannot be easily got at, but in a convenient spot (by the side of the kitchener if possible), with a good light overhead. A gas-stove fixed in the kitchen is always kept in much better order, and better cared for, than one relegated to the scullery.

(26) Cooking-stoves do their work better without a flue-pipe. If the gas is turned half-way off during cooking, there is no occasion for a flue; and the Company's lecturer (Miss Edden) never advocates its use or has one put to her own stove. If a flue be used, it must not be carried into the open air.

(27) Fitters must explain the use of the different parts of the cooker to the consumer or the servants, if requested to do so; and always point out to the consumer that the Company are prepared to send, if desired, an expert lady demonstrator to give full instructions in the use of gas for cooking—carefully noting and reporting any request for the demonstrator to be sent.

LII.—*Leaving Premises—Clearing up and Leaving as Found.*

No workman should leave a consumer's premises unobserved; but, after clearing up and leaving as found, should take care to announce that he has finished for the day, or completed the work, as the case may be.

Upon leaving premises after the completion of a job, it is desirable politely to draw the attention of the consumer, whenever possible, to the work executed (together with improvements made, if any) for the purpose of obtaining an expression of satisfaction, which should be recorded in the pocket work-book at the time.

LIII.—*Avoiding Waste of Time and Material.*

Care must always be taken not only to avoid waste of time and material in the carrying out of any job, but also to see that any materials (however small in quantity) left over on its completion are duly returned to stores. The Company's annual expenditure on wages and materials is very heavy; and if every man would always do his utmost to avoid and prevent waste of time and material, the saving to the Company would be considerable—and, as every sensible man is aware, the cheaper the Company can work, the cheaper they can sell gas; the lower the price of gas, the more gas is sold; and the more gas there is sold, the more labour is required for its manufacture and distribution.

LIV.—*Subways.*

[This rule contains regulations relating to work in London subways, and would not be of general interest.]

LV.—*New Unvalved Services—Avoiding Work with Live Gas.*

In the case of new unvalved services being laid to warehouses, factories, hotels, or other large buildings, where the Company have undertaken the work of extending the service to the meter position, arrangements are made for a fitter to attend at the same time as the service-layers, to carry out the inside work (including the fixing of the main-cock) before gas is put into the service. Notice is given by the Mains Department of the day and time the service will be laid; and care must be taken to see that the fitter is in attendance in good time, so as not to delay the service-layers. The fitter must in all cases test his work after the service has been charged.

LVI.—*Connections to Existing Carcase Pipes.*

No existing, but temporarily disused, carcase pipes in any premises may be connected to the Company's service and left charged with gas until those pipes have been put under a gauge test with 6-inch pressure, and have been passed by the foreman as sound.

MANTLE MAINTENANCE.

Note.—The following Rules apply specially to maintenance fitters, who must, however, note carefully all the preceding rules, as many of those rules apply to them as well as those which follow.

LVII.—*Uniform.*

Upon entering the Company's service, each maintenance fitter is provided with a uniform cap, and at a later period with a complete uniform, consisting of tunic, vest, pair of trousers and overcoat; and the Company hold him responsible for the safe custody of each of the above. The uniform must be produced complete at any time when called for, and must be returned to the Company whenever the fitter leaves the service.

LVIII.—*Box and Tools.*

Each fitter is supplied with a maintenance box containing sundry tools and materials; and he is held personally responsible for the safe custody of these, and required to pay for the replacement of any article missing at any time an examination is made. The box and contents must in every case be left with the storekeeper each night.

LIX.—*Stock.*

Each fitter will be held responsible for all goods issued to him daily, and should any be missing at any time, he will be liable to pay for the replacement of same, or to dismissal if he cannot give a reasonable explanation of the shortage.

LX.—*Loops, Ash, and Boxes to be returned to Stores.*

The fitters are required to collect and bring in to the stores the asbestos loops of all mantles replaced, together with the ash of the old mantles, and to bring back all the empty cardboard mantle-boxes.

LXI.—*Pocket Book.*

A pocket book is supplied to each fitter, in which he is to make all notes necessary during his work, including any request of consumers or their servants, and to report the same in writing immediately on his return to the office, in the book kept for that purpose.

LXII.—*Orders from Consumers.*

An order book is issued to every fitter, and he must respectfully ask the consumer to sign an order for anything required outside the usual maintenance work, unless the maintenance card contains instructions

to supply free of charge. If his order book is lost at any time, the fitter is liable to be suspended from duty until the same is found.

LXIII.—*Fitters not to accept Payment or do Work on their own Account.*

Any fitter accepting payment from any consumer for any goods or for any work done, or undertaking maintenance work on his own account, will render himself liable to prosecution as well as dismissal.

LXIV.—*Usage of Mantles.*

The usage of mantles must be kept as low as possible, compatible with the maintenance of efficient lighting. All causes of heavy usage must be promptly reported.

LXV.—*Daily Report Sheets.*

The time of arrival at consumer's premises, and of leaving, and all material used on each job, must be correctly entered on the report sheet, on the completion of the job.

LXVI.—*Correct Particulars on Card.*

Fitters must see that the name, address, and all particulars on the inspection card are correct, and report any alteration required on return to the office. On no account may the fitter alter the card.

LXVII.—*Contract.*

On being given contracts to verify, the fitter must carefully count the burners, and ascertain that the number and type agree with the particulars shown on the contract, and that the contract covers all the incandescent burners on the premises. On no account must he make any alteration, but must report any discrepancies at the office.

LXVIII.—*Escapes.*

Escapes must be reported immediately on return to the office. Fitters must, if possible, temporarily secure the same with white lead while on the premises. If the escape is serious, the fitter must at once telephone or telegraph to the office, giving all particulars.

LXIX.—*Complaints of Bad Supply of Gas.*

Complaints of bad supply must be carefully noted and be reported on return to the office; but the fitter must first be careful to make quite sure that the complaint is not due to defective or dirty burners.

LXX.—*Fixing Globes.*

Fitters must use special care, in fixing globes of lamps or of inverted burners, to see that they are left secure, but not screwed up too tightly. Sufficient room must always be left for expansion by heat—say, about $\frac{1}{16}$ of an inch at least.

LXXI.—*Breaking of Globes.*

Any globe broken by a fitter during his day's work must be noted in his pocket book and replaced the same evening. In all cases where a globe is found cracked, the fitter must draw the consumer's attention to the fact, and ask for an order to replace, before attempting to touch same—unless he has instructions on the card to replace free.

LXXII.—*Use of Trestles, &c.*

On no account must trestles or steps be left unprotected in the public footway. A fitter using them should ask one of the consumer's employees to keep watch, should he have cause to leave them.

LXXIII.—*Bonus.*

Fitters are paid a quarterly bonus of 4d. for every burner maintained on the average per day by the fitter in excess of an average of 150 burners per day, provided the work is carefully and properly carried out, and that the attendance and general conduct of the fitter is in every way sa isfactory.

Unaccounted-for Gas and Consumers' Meters.

SIR,—Mr. Norton Humphrys, by his communication which appears in your issue of the 9th inst., considers that a large portion of unaccounted-for gas is attributable to consumers' meters, owing to insufficient importance being attached to the test for soundness apart from slow registration; and he offers several suggestions for consideration, with a view to the amendment of the law. I believe many of your readers will agree with me that insurmountable difficulties would be met in attempting to put into practice the proposals stated, while no suggestion is made of the more important matter of varying speeds and pressures that is raised by the communication.

To take first the illustration of the ten-light meter. This can, as Mr. Humphrys states, be tested for soundness while passing 3 cubic feet per hour, but may also be tested while passing only $\frac{1}{2}$ cubic foot per hour. Seeing that the object of such tests is to determine if small amounts are recorded, the $\frac{1}{2}$ cubic foot test is the better procedure; and a more stringent test for unregistered gas, in practice, could not well be imagined.

The striking out of the percentage error slow allowed in favour of the buyer, would appear somewhat supported by official certification; but when dry meters do not pass unregistered gas at the valves, or their measuring chambers are not defective, the tendency is that they become faster after a time in use, until either the valves or the chambers are defective. The turn of the scale would, up to this stage, have a strong tendency in favour of the seller. The certificates referred to are evidently for meters beyond this stage; and if so, they could not well be taken as representing the state of the meters when approved and stamped as legal measures.

The Act is considered to provide against the stamping of meters that are capable (by any means prevented in good meters) of registering in error beyond certain limits. There are good meters that will register correctly under varying speeds and pressures; and, obviously, it is necessary to make certain other tests that are not actually prescribed, in order to ensure that only such meters are stamped.

My object in making the foregoing statements is to give what I consider the more practical side of an important question. In my opinion, were periodical testing established by law, the Act would, of necessity, be more generally adopted, and every facility for the testing of meters officially would be thereby provided, and defects such as those Mr. Humphrys sets forth would be prevented. The methods of other tests if actually prescribed, would make more clear the importance of section 12 of the Sales of Gas Act. This, of course, may not cover all that is desired; but it would meet the difficulties raised.

F. COE.

Nottingham, July 18, 1907.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Thursday, July 18.

(*Before Mr. Justice* BRAY.)

Attorney-General v. Felixstowe Gas Company—Question as to Liability for Stamp Duty.

This was an information which came before the Court in the form of a special case raising the question whether the defendant Company were liable to pay an *ad valorem* stamp duty, amounting to £118 15s., with interest, on their Act of 1904, on the ground that it vested the property of the former limited Company in the new Company "by way of sale," and so came within the provision of the Finance Act, 1895.

The SOLICITOR-GENERAL and Mr. FINLAY appeared for the Crown; Mr. CRIPPS, K.C., and Mr. SPENCE represented the respondents.

Mr. CRIPPS said he should admit at once that there was no question of figures, if there was here a conveyance by way of sale; but his contention was that there was no sale. In order that there should be a sale, there must be two parties, the vendor and the purchaser; and in most of the cases which had arisen, this had been the real question at issue—whether there were two contracting parties. Here it was impossible that this could be the case, because the old Company was dissolved at the same moment that the new one came into existence by virtue of the Act of Parliament; so that they were never in existence at the same time, and could not therefore contract with each other. Counsel went through various cases in which it had been held that the stamp duty was payable, and pointed out how, in his view, the present case differed from them.

The SOLICITOR-GENERAL having addressed a very short argument to the Court,

Justice BRAY, in giving judgment, said the question turned on a few words in section 12 of the Finance Act, to the effect that, after the passing of the Act, if by virtue of any Act any property is invested in any person by way of sale, the duty was payable. He had to consider, therefore, whether it was satisfactorily shown here that by this Act of Parliament property was vested by way of sale in any person. It was quite clear that the two persons were different—the two Companies were different entities, the limited Company and the new statutory Company. It all came back to the question: Was the property vested in the new Company by way of sale? What was necessary for a sale? No doubt, without the help of an Act of Parliament, it was necessary that there should be two parties, a consideration, a consensus, and a transfer. The difficulty suggested here was that no two parties ever existed at the same moment, and, further, that there was no concensus, because, inasmuch as the two parties never existed at the same moment, there could be no consensus, which meant a meeting and agreement of the minds of the two persons together. He thought, however, that the concensus might be inferred from the Act of Parliament. It might be an artificial consensus, not a real one; and the two parties might not be alive at the same moment. But if one could see from the Act of Parliament that it was all based on a real consensus between the new Company and the old one, in his opinion the Act might create that which the two persons together could not do. And in this case he thought the Act did create a consensus between the two parties. Equally it might be said that a transfer meant a transfer from one existing person to another; and that these two persons never existed together at the same time. But he thought the Act might supply this deficiency, and might say this was to be treated as if it were a transfer from the one Company to the other. This view was supported by Lord Esher's judgment in *Great Western Railway Company v. Commissioners of Inland Revenue* (L.R. 1894, 1 Q.B.), where he appeared to think that the words "by way of sale" were satisfied if the transfer of property was for consideration, as if it were a contract for purchase and sale. It seemed to him (his Lordship) that it was not necessary in terms that there should be two parties existing at the same time and actually agreeing. In his opinion, therefore, this property was vested, by way of sale, in the new Company; and consequently the duty was payable.

Judgment was therefore given for the amount claimed, with interest and costs.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Monday, July 15.

(*Before Mr. Justice* SWINFEN EADY.)

Edge and Others v. Metropolitan Water Board.

This was an action brought by the freeholders of certain houses in Crescent Grove, Clapham, to obtain a declaration that the defendant Board are liable, under an agreement entered into by their predecessors, the Southwark and Vauxhall Water Company, to supply houses on the Crescent Grove Estate with water at the yearly rent of 34s. per house, and are not entitled to enforce any higher charges.

Mr. EVE, K.C., and Mr. KENNETH WOOD appeared for the plaintiffs; Mr. DANCKWERTS, K.C., and Mr. HAROLD BURROWS represented the Water Board.

Mr. EVE said the first plaintiff, Mr. Edge, was the owner in fee of four houses on what was known as the Crescent Grove Estate; the plaintiff Clark was the owner of another house; and the plaintiff Alfred Clarkson was also the owner of a house, though it stood in the name of his wife, and he and Mr. Edge had been appointed Trustees of the original agreement. The Crescent Estate was conveyed in 1824 to Francis Child, and by the year 1830 some 39 houses were erected upon

it, when he began to dispose of them. Mr. Samuel P. Child, through whom Mr. Edge claimed, became the owner of one of these houses. The original Southwark Water Company was incorporated in 1834, and on Sept. 25, 1841, the Company entered into the agreement on which the action was founded. In 1845, the Act was passed under which the Vauxhall Company was merged in the Southwark Company; and one of the defences appeared to be that at this time the Southwark Company ceased to exist, and the agreement, if made, came to an end. Various other Acts were obtained from time to time; but the agreement was continuously acted upon down to 1902, when the Act was passed incorporating the defendant Board. This provided that on the appointed day, which was June 24, 1904, the undertakings of the various Metropolitan Water Companies should vest in the Board; and all their rights and obligations were transferred to that body. For two years the defendants continued to supply water on the old terms; but last September they gave notice that they would not do so any longer, and those who were interested in the estate had to look carefully into the matter. After an industrious search, the agreement was discovered in the possession of some solicitors who had represented the owners of one of the houses; and it was now produced. By an indenture dated March 19 last, made between some of the freeholders and Mr. Edge and Mr. Clarkson, the last two gentlemen were appointed Trustees of the original agreement, with the right to sue on the covenants therein contained. The learned Counsel read the agreement, which was made between the Southwark Water Company of the one part and Samuel P. Child and George Child, on behalf of themselves as freeholders, and as Trustees for and on behalf of the other freeholders of the several houses mentioned, and provided that the Company should, at their own expense, lay mains and pipes so that pure filtered water should be used by all the occupiers, receiving a payment of £30 for the first year, and from and after December, 1842, would supply the houses specified, and as many others as should be built on the estate, at the rate of 34s. per annum, to be paid by the occupier for the time being. A provision was inserted that the charge should not be payable if and when any of the houses were unoccupied. In the event of the Company not performing the agreement, becoming dissolved, or ceasing to exist, the mains, pipes, &c., should become the property of the Trustees for the benefit of themselves and the other freeholders. The Trustees also covenanted that the Southwark Company alone should be permitted to supply the houses on the estate with water. At this date, the Act of 1834 was in force; and one of the defences raised was that the agreement was altogether *ultra vires*. He, however, did not see how this could be sustained. Having briefly referred to the other Acts, the learned Counsel read section 45 of the Act of 1902, which stated that all contracts, agreements, &c., subsisting immediately before the appointed day, and affecting any Metropolitan Water Company, should have as full force and effect against, or in favour of, the Metropolitan Water Board as if, instead of the Water Company, the Water Board had been a party thereto. Having referred to the various defences raised, he said the whole question was whether the dissolution of the Southwark and Vauxhall Water Company had in fact put an end to the agreement; and he submitted that it had not.

Mr. DANCKWERTS addressed a long argument to the Court on behalf of the defendants. He submitted, in the first place, that the agreement was entirely *ultra vires;* that even if the Company had power to enter into it it was invalid in itself on various grounds, and that the present plaintiffs had no authority to sue upon it. If the construction put upon it by the plaintiffs were correct, he submitted that it would offend the rule against perpetuities. But the obvious intention was that the agreement should come to an end if the Company was dissolved; and as this had taken place, the agreement was no longer in existence. On the whole, he submitted that the contract was not one which could be enforced.

Mr. BURROWS followed with an argument on the point as to whether the plaintiffs were entitled to sue.

Tuesday, July 16.

Mr. BURROWS continued his argument this morning, and submitted that, assuming the plaintiffs were freeholders, they must show that the benefit of the covenants in question ran with the land; and this could not be the case, as there was no privity of estate between the covenantor and covenantee, which, in his view, was essential. He developed this abstruse legal argument at some length, and cited several authorities in support of it.

Mr. EVE having replied,

Mr. Justice SWINFEN EADY gave judgment. After reciting the agreement and the relevant sections of the Act of 1902, his Lordship said the first question that arose depended on the true construction of section 45 of the Act. Was it to put the Water Board into the position for all purposes of the Water Company, and was it to be read as if it contained the words: "The Water Board shall, as from a certain date in the past, and thenceforth during the continuance and existence of the Board, supply water" at the fixed rate? Sub-section (*b*) set forth: "All contracts and agreements subsisting immediately before the appointed day, and affecting any Metropolitan Water Company, shall be of as full force and effect against or in favour of the Water Board, and may be enforced as fully and effectually as if, instead of the Company, the Water Board had been a party thereto." The first step was to see what was the position immediately after the appointed day—June 24, 1904. Assuming the agreement of 1841 had been valid and enforceable in every respect, then, until the Southwark and Vauxhall Water Company was dissolved, the provisions of the agreement were to have full force and effect against the Water Board; so that from June 24, 1904, until June 5, 1906 (when the Company was dissolved by publication in the "London Gazette" of the Board of Trade certificate to this effect), if there were no other objection to the agreement, it could have been enforced against the Water Board as fully and effectively as it could against the old Southwark Company. But, in his opinion, this section dealt with enforcing contracts against the Board, and did not alter the substantive rights of the parties. The agreement was only to continue, according to its tenor, during the continuance of the Company; and in the provision for enforcing contracts against the Board, he was unable to find any words which justified him in altering the substantive contract, and saying that it was to be read as if it were to continue during the existence of the Board. At the date of the agreement, it perhaps might have been contemplated that the undertaking of the Southwark Company might have been sold or transferred to some other company, in the same way as the Vauxhall Company was transferred to the Southwark Company; and probably the latter Company did not intend to fetter themselves by any contract enduring longer than, according to the tenour of the instrument, this was to endure. In his opinion, the effect of the section, while it enabled the contract to be enforced against the Board, only enabled it to be enforced according to the tenor of the contract itself; and so soon as the Southwark and Vauxhall Company were dissolved, the agreement came to an end. Under these circumstances, he thought the action failed, so far as it claimed to enforce the right to have water at a specified charge. Assuming every other point in the plaintiffs' favour, this point was fatal to the success of the action, which must be dismissed, with costs.

GREENWICH POLICE COURT.—Thursday, July 18.

(*Before Mr.* CECIL CHAPMAN.)

Lewisham Borough Council v. South Suburban Gas Company.

Alleged Nuisance—The Disposal of a Gasholder's Tank Water.

This was a summons issued, on the application of the Lewisham Borough Council (who were moved to take action by certain inhabitants in the district), against the South Suburban Gas Company for causing effluvia in the manufacture of gas.

Mr. A. S. POYSER appeared for the Council; Sir CHARLES MATTHEWS, K.C., for the Company.

Mr. POYSER, in opening the case, said the information alleged that the Company, in the manufacture of gas at Lower Sydenham, caused effluvia; and this was certified to the Sanitary Authority by ten inhabitants of the district as being a nuisance. What he said was that the Company unlawfully carried on their business so as to cause a nuisance. The date more particularly charged was April 11, when the inhabitants suffered especially from the nuisance. This was the only date charged. No doubt the effluvia had been there some days before; but on April 11 it was worse than on any other day, and that was the day particularly for which they claimed a fine in regard to the nuisance. The information was laid under the Public Health Act, 1891, section 21:

> Where any manufactory, building, or premises used for any trade, business, process, or manufacture, causing effluvia, is certified to the Sanitary Authority . . . by any ten inhabitants of the district of such authority to be a nuisance or injurious or dangerous to the health of any of the inhabitants of the district, such Authority shall make a complaint; and if it appears to the Petty Sessional Court hearing the complaint that the trade, business, process, or manufacture carried on by the person complained of is a nuisance, or causes any effluvia which is a nuisance, . . . then unless it is shown that such person has used the best practicable means for abating the nuisance, or preventing or counteracting the effluvia, the person so offending . . . shall be liable to a fine not exceeding £50.

The Gas Company were within the section as the person liable for what took place in the manufacture of gas. The Company's works were situated at Lower Sydenham; and the district was hilly, with a gradual rise from the works up to a very important residential area. The inhabitants of this area had suffered at the hands of the Company very considerably, through the smells they made. It was not the ordinary smell of the gas-works; but something far beyond the ordinary. All the signatories to the certificate were well-known gentlemen in the locality; and they occupied houses of considerable value at a short distance from the gas-works on the rise towards Sydenham. Most of them were situated in the Dacres Road, which was a purely residential road. The gentlemen who inhabited these houses would all come and tell his Worship that the smell had been practically unendurable—especially so on the 11th of April, when the stench was such as to make living a positive burden. The Medical Officer of Health and the Gas Company were spoken to on the matter; and the latter suggested that the smell was owing to the sewers. This was a gas smell and not a sewer-gas smell at all. The Medical Officer of Health, in consequence of the complaints, went to the gas-works, and saw Mr. Shoubridge, the Company's Engineer, who pointed out to the Medical Officer certain work they were doing on the premises, which certainly conduced to a very obnoxious smell. That alone would be a sufficient corroboration of the witnesses' declaration that the smell did come from the gas-works. The suggestion made at the gas-works was that it was due to a temporary operation there. But it was an operation that might recur; and so there was no option but for the Sanitary Authority to take action.

Mr *J. R. Furneaux*, of Boxgrove House, Mayow Road, Forest Hill, stated that he had lived there for some 37 years. His house was rated at £175. The district was a residential one, with good houses all round. He was a Past-Master of the Leathersellers' Company; and they owned large estates in the neighbourhood. He himself owned several houses there. With regard to the smells, they were particularly strong about the beginning of April; and on the 11th of that month, he noticed it more than usual. The nuisance had been in existence, and growing in intensity, for some period about that time.

His WORSHIP: Do you mean that the nuisance lasted all day, or was it at a particular period of the day?

Witness replied that he had noticed it more particularly at night. Returning home one night by a train arriving at Lower Sydenham at 12 minutes to 10, the smell was "most atrocious;" and as he got farther from the works, the smell became less. It was so "atrocious" about this period that it was enough to take one's appetite away.

Examination continued: Although the smell lessened as he got nearer his residence, it was most offensive there. His house was about ten minutes' walk from the station. Since the notices had been out for this matter, the smell had subsided. He had gone out purposely of an evening by the gas-works, and he had found the smell had subsided.

His WORSHIP: You do not mean subsided, but disappeared.

Witness: Yes.

In cross-examination by Sir CHARLES MATTHEWS, witness was asked at what date he fixed the "notices having been out for this matter." His reply was when the first subpœna was issued—about July 3. Before then, the smell had been growing gradually more and more. He believed it had been in existence a year or two; but it had been growing more and more until it became nauseous in the extreme. The question was put as to when he last noticed the smell; and he replied about a month after April 11 and 12—say, about the middle or the end of May. His house was about 733 yards from the works; and there were residences much nearer the works than his. So far as his knowledge went, there had been no complaints regarding the sewers in recent years; and the sanitary arrangements of the district he believed to be good now. He was about the neighbourhood in all directions, but he did not know a large sewer was being laid in this immediate vicinity.

Re-examined: The houses between the gas-works and his house were at a lower level. The smell that he had noticed near the gas-works was the smell which extended to his house, only it was modified the further he got from the works.

His WORSHIP: You say the smell was particularly offensive. The ordinary smell of a gas-works is not offensive; it is disagreeable. You do not mean this was an ordinary gas smell.

Witness: It is the smell that I have noticed on passing the gas-works.

Mr. *Walter Mason*, of Woodfield, Dacres Road, Forest Hill, deposed that he had resided in his house for fourteen or fifteen years. Whenever this year the wind had been in the east, they had been virtually "stunk out." He noticed the smell particularly on April 11, about a quarter past eight in the evening. He had observed it as far off as Forest Hill Station that evening. Going later down the hill in a line with the gas-works to a friend's house in the Mayow Road, the stench was simply abominable. The smell was still "on" when he left his friend's house; and even next morning they could smell it. The smell generally happened in the evening, and sometimes in the middle of the night. It not only interfered with the comfort of living, but interfered with the growth of plants. It produced an oily film on the leaves, which looked almost like blight. They had had the smell worse this last March and April, whenever there was an east wind.

Cross-examined: His house was about 700 yards away from the gas-works. The smell had not ceased. They had it only the previous Sunday evening, and again on Monday morning. He had never heard of any complaints against the sewers in his neighbourhood. He had some knowledge that a hole had been dug in Lower Sydenham; but he could not say whether this was due to alterations in the sewerage system. However, that would not be in such a direct line with his house as the gas-works. He did not know the number of sewer ventilators in the road near his dwelling; but there was an ordinary grating in the middle of the road, which he supposed was connected with the sewers. They had the smell whenever there was an east wind; but he did not know the direction of the wind on April 11. They had the same smell very badly in 1904; and it ceased more or less for two years. Now it had come on again strongly. He could not say that the smell in 1904 was due to lime purification; and he did not know that the process had been abandoned at the works.

Mr. *Gilbert R. Redgrave*, of "Thriffwood," Silverdale, Sydenham, Assoc.Inst.C.E., and Assistant-Editor of the Engineering Supplement of "The Times," also stated that, whenever the wind was in the east, or varying a little round that quarter, they had at his house the intolerable smell of sulphuretted hydrogen. He had a great knowledge of the effects of this gas. Many years ago, working as an engineer, he happened to be accidentally poisoned by it, and ever since then he had been specially subject to poisoning by sulphuretted hydrogen. He had several times of late been awakened in the night by sulphuretted hydrogen, borne by the east wind. His house was some 3350 feet west of the gas-works. The smell was particularly strong on April 11, and on previous and subsequent days. He was astonished that the smell should be so concentrated at such a distance from the works.

In cross-examination, witness was asked whether he would not expect, having regard to the pungency of the smell, that it would arise from some source nearer to his house. His answer was that he should not; and that he believed it to be solely produced by the process used for enriching the gas.

His WORSHIP: Enrichment by what?

Witness: Carburetted hydrogen.

Cross-examination continued: He had only lived in his present house three or four years, and had noticed the smell on and off ever since—at any rate, very badly for the past twelve months, and almost up to the present date. He had never heard of any complaints regarding the sewers in the district; and he had never noticed any smell from sewer ventilators in the neighbourhood of his house. The smell was entirely different from sewer gas.

Mr. *G. J. Freund*, Lancaster House, Dacres Road, said he had no doubt about the smell coming from the gas-works. It was so bad that they had to close their windows at night; and both his wife and maids had complained. As to the suggestion of sewer gas, it was nothing of the kind.

Cross-examined: Regarding the controversy in 1904, he could not say whether or not lime purification had been discontinued at the gas-works, nor could he say that he had noticed any difference between 1905 and now. His house stood in a line with the gas-works—about 600 yards away. The smell was noticeable at intervals from January to March this year, culminating about the middle of April. Since then the inconvenience had diminished; but it certainly had not ceased. The week in April was unquestionably the worst. He had never been under the impression that the smell came from the sewer ventilators.

Mr. *T. Fletcher Adams* was then called, but

His WORSHIP intervened with the remark that he did not think it necessary to waste the time of these gentlemen further. He thought he could assume that they, being signatories to the complaint, were in agreement.

Sir CHARLES MATTHEWS said he did not want to see more of them; he assumed they would give the same evidence.

Mr. *J. H. J. Selye*, of "Ightham," Mayow Road, asked to be allowed to give evidence. He corroborated the testimony of previous witnesses, and added that the processes the Company had in use for some four years were very objectionable; but since the adoption of their new processes, the smells had been remedied, though not cured. They still continued, but had certainly diminished. The smell, however, increased in intensity on and about April 11.

Dr. *Arthur Wellesley Harris*, Medical Officer of Health for Lewisham, said that on April 18 he personally noticed a nuisance existing in his district, apart from the complaints he had received. It was late in the evening; and the odour was perfectly characteristic of gas-works. There could be no doubt that the odour arose from the waste material of the gas-works, or from the contents of a gasholder tank. On April 19 he paid a visit to the gas-works, and saw Mr. Shoubridge. In consequence of the observations he (witness) made on the 18th, he asked Mr. Shoubridge whether they were discharging refuse matter into the sewers. His reply was that he had no other place to put it. The material was highly gaseous in its composition; and being put into the sewers, and the sewers being warmer than the refuse, would lead to evaporation of the gaseous constituents very quickly, and on a still night would fill the whole of the district through which the sewers passed. If the wind was blowing, it would, of course, diffuse quickly. Where he lived, he noticed it more particularly when south winds were blowing. The odorous material came from the gasholder tank; and it was in carrying out work on the gasholders that they had to get rid of this material. The emanations from the sewer-openings were caused by the material the Gas Company were putting into the sewers.

Sir CHARLES MATTHEWS: You see we were not far wrong.

Examination continued: The top being partially off the holder at the works, the gaseous constituents would evaporate in large bodies. It would depend greatly on the direction of the wind as to the residences this would affect. He could quite understand that if this oily material was carried in a fine state of division, it would settle. The nuisance had diminished considerably. Some, however, still existed. He noticed it between 8 and 9 o'clock the previous Sunday night; but it was nothing like so pungent as on April 18.

Cross-examined: According to his observations on April 18, the smell did come from the sewers—from outside the works, and from the districts below through which the sewers passed after leaving the works. The sewers on which he made his observations were a considerable distance from the residences of the complainers. The gas would, of course, pass up side sewers. On April 19, Mr. Shoubridge was good enough to show him the condition of the contents of the gasholder tank; and he explained to him what was being done in the enlargement of the holder, and also that it was necessary to pump the water away. It was obvious that it was impossible, having regard to the length of time the water had stood there, to avoid some smell.

Sir CHARLES MATTHEWS: Did he ask you whether the best means were not being used, having regard to the necessary alteration of the gasholder, to avoid the smell.

Witness: I do not think he would ask me a question on that point. I think he said: "What else would you do?"

Did you agree that he could not do anything else?—No; certainly not.

I put it to you, Dr. Harris, that you did?—I must leave that with my denial.

You agree that the Company to carry on their business must from time to time make alterations in their plant?—Absolutely.

Did he tell you how long the water had been in the tank?—May take it you mean the sediment or the water?

The water?—No.

Did he give you about seventeen years as being about the time?—That was the time for the sediment.

And did you say that what must be done must be with as little smell as possible, and that he was to get the water out as quickly as he could?—I agreed they must dispose of the water.

Did you suggest how it was to be done?—No. Mr. Shoubridge said he had taken the best means.

Did you say to him: "Don't put the water into the river?"—No.

Put it into the sewers?—No, absolutely.

You are quite sure about that?—Absolutely sure.

While you were at the works, did you see them turning water into the sewer?—I did not. There was no action going on at the time.

Did you see a pipe there?—Yes, in the bottom of the tank.

By means of which the water was being carried to the sewer?—I presumed it was. They admitted that they were putting it into the sewer, because Mr. Shoubridge told me in the presence of those who were with me they had been doing so.

Did you raise any objection to that?—I said it was a serious thing putting it into the sewer. That was what made Mr. Shoubridge say "What else would you do?" To that I made no answer.

I suggest that you said he was not to put it into the river, and that he was to put it into the sewer?—I am absolutely confident I did not.

In further cross-examination, witness said that wherever there were sewers, they had complaints; but the smell was a totally distinct one. He knew that the cleansing of the sewers went on at night time; but he was not aware of complaints as to the sewers being too small. There was a large sewer now being constructed in the immediate neighbourhood of the gas-works in Sydenham Road. He believed this was to provide additional drainage facilities for the neighbourhood.

Re-examined: He did not direct that the water should be pumped into the sewers. That he knew was an offence.

Mr. POYSER: For which the Company are not being prosecuted. I hope they do not complain of that.

His WORSHIP: Can you speak as to whether this nuisance could be traced to temporary works—enlarging holders and things of that kind—which might cause temporary inconvenience, but yet be unavoidable?

Witness: It has to occur from time to time. This nuisance, however, has been going on for some considerable period; and it has been aggravated.

His WORSHIP: The suggested defence is that this is an unavoidable trouble.

Mr. POYSER: I gather from my friend's cross-examination of witnesses that he is going to set up the defence that the Company have taken all

precautions. Now till we know what they have done, and what they allege to have done, it is impossible for us to meet that case. Therefore it will be necessary to ask for an adjournment.

Mr. *B. Nappett*, one of the Sanitary Inspectors, also gave evidence.

Sir CHARLES MATTHEWS, in addressing his Worship, said he hoped he would dismiss altogether from his mind anything which had relation to 1904; and for this reason, that from that time there had been in use a different system of purification, and there had been complete freedom from all possible offence as from the gas-works. Coming to April of this year, it was necessary to enlarge a pair of gasholders—to add additional lifts; and for that purpose, and to sink new rest-stones, the holder tank water had to be pumped out. The work which was said to be the cause of offence was finished on the 24th of May; and if he could prove, as he believed he could prove, that the work was done in the best possible manner, then he should submit that, under the section of the Act, the nuisance was an unavoidable thing, and of short duration. The witnesses had deposed to the same smell in the winter and the summer months; but this could not have arisen from the gas-works, because the cause disappeared on May 24. As between the 11th of April and the 24th of May, there was something; but his evidence would show that the best practicable means were taken in carrying out the work.

After a brief discussion between his Worship and Counsel, it was agreed at this stage to adjourn the proceedings—there being no reasonable prospect of finishing the case at that sitting.

DUBLIN POLICE COURT.—Thursday, July 18.

The Quality of Dublin Gas.

To-day judgment was given on three summonses taken out by the Dublin Corporation against the Alliance and Dublin Consumers' Gas Company, complaining that the Company had failed on three specified nights—viz., the 28th and 29th of January and the 4th of February—to keep the gas up to the specified standard of 16-candle power. The cases occupied a considerable time in hearing; and the proceedings were duly reported in our columns.* The Corporation relied on the evidence of Mr. Thomas J. Cotton, their Official Gas Examiner, who proved that under his tests the gas failed to come up to the specified standard. The defendants impugned Mr. Cotton's method of testing as being defective, and not carried out either in accordance with the terms of an award adopted by both parties in 1889 or with modern practice. They also produced proof that Mr. Cotton's tests were invariably below the results arrived at by the late Professor Tichborne when he was Gas Examiner under the Board of Trade, and also below those of Professor Lewes, who had tested the gas since then. At the close of the hearing on the 1st ult., the Divisional Magistrate (Mr. Swifte, K.C.) who had tried the case reserved judgment, and expressed his intention of visiting the testing-station, and inspecting the instruments used in testing the gas.

Mr. SWIFTE, in the course of a long judgment, announced his intention of dismissing as not proved the two principal charges, and of imposing a penalty of £1 with respect to the third day, when the defendants admitted that, owing to a previous accident at the gas-works and the subsequent leakage in some of the pipes, there was a slight deficiency in the illuminating power of the gas. Having referred to the highly technical character of the case, his Worship said he regretted that the statute did not provide that in such circumstances he should have the assistance of an assessor. The defence practically was based on the unreliableness of Mr. Cotton's testing; and the records of Professor Tichborne's testings were offered in evidence. These showed that for a considerable period anterior to 1905 he and Mr. Cotton continually differed in their results; those of Mr. Cotton being adverse to the defendants, while Professor Tichborne's figures were in their favour. Mr. Cotton also differed from Mr. Brent, who officially tested for the Gas Company, and also from Professor Lewes, the Superintending Gas Examiner to the Corporation of London, who was brought over as an expert witness on behalf of defendants. There must be some explanation of this permanent and substantial difference between Mr. Cotton and Professor Tichborne, extending over a period of years. Both were presumably equally competent and impartial. On this point he was impressed with the emphatic evidence of Professor Lewes as to the necessity of using a cubic foot measure for the purpose of securing that the exact quantity of gas passed through the meter, and also as to the incompleteness of the test if it was not corrected by the readings of the thermometer and barometer for temperature and pressure. Professor Lewes was positive in his opinion that any tests carried out without making these corrections were not worth the paper they were written upon. On the other hand, Mr. Cotton held tenaciously to his own views, and maintained the accuracy of his tests. Professor Tichborne's records had been objected to by complainants as being inadmissable; but, on the whole, he had decided to accept their evidence as affording reasonable presumption with reference to the principal matters in dispute. He wished to speak with great respect of Mr. Cotton as an official of long experience, who did his duty with great conscientiousness. But he seemed to stand too rigidly by opinions which were formed many years ago, and which in some respects had been superseded. Having regard to the evidence placed before him in opposition to Mr. Cotton's direct testimony that the gas was defective, he was obliged to come to the conclusion that the charges as to the 28th of January and the 4th of February had not been proved. As to the 29th of January, it was admitted by the defendants that there was a deficiency owing to an accident three weeks previously. With respect to this date, the statute left him no alternative but to convict; and he would impose a penalty of £1. In conclusion, his Worship said he had carefully considered the question of costs, and would allow the defendants £20 in respect of the two summonses on which there was no conviction. On the other the Corporation would be allowed, in addition to the £1 penalty, a sum of £4; the total of £5 to be set off against the £40.

* See "JOURNAL," Vol. XCVIII., pp. 397, 468, 597, 673.

BREWERY WELL LITIGATION IN EDINBURGH.

A second action has been raised in the Court of Session, Edinburgh, at the instance of Messrs. James Muir and Son, Limited, brewers, of the Calton Hill Brewery, Edinburgh, against the Edinburgh and Leith Gas Commissioners, with reference to the pollution of a well. The former action was disposed of by the Second Division of the Court on May 29, and the summons in the present action was signeted on June 19. In it, the pursuers conclude for £15,000. In their statement, the pursuers say that their business has been in existence for upwards of a hundred years, and it has always enjoyed a high reputation. Within the premises there are two wells, upon which, previous to the pollution complained of, the brewery depended for its supply of water, which is specially suitable for brewing; and the reputation of the pursuers' brewery has been created and preserved by the particular class of beer which this quality of water produces. One of the wells, known as the Stable Well, is on the south side of the North Back of Canongate; while the other, called the Brewery Well, is on the north side of the thoroughfare. The New Street Gas-Works, belonging to defenders, are situated almost immediately to the west of the brewery. The gas-works were dismantled about April, 1904, and since that time the defenders have ceased to manufacture gas therein. In the month of July, 1904, the water in the Stable Well became seriously polluted, and rendered unfit for use in the brewery. The pollution was caused by tarry matter, chiefly water-gas tar, percolating from the defenders' works into the well, through the intervening strata, which dip in the direction of the well. On Feb. 8, 1905, the pursuers raised an action for damages against the defenders; and Lord Ardwall, in June, 1905, found that defenders were the authors of the pollution, and were liable for it. On the footing that the pollution would probably last for ten years, and that the Brewery Well would continue free from pollution, he gave decree for £3730. That decision has been upheld by the Second Division of the Court of Session. The pollution of the Stable Well still continues, in spite of persistent pumping; and the water in it will be unfit for use for many years to come, if it ever becomes good again. In or about the month of February, 1906, the other well in the pursuers' premises—called the Brewery Well—also became seriously polluted, by similar tarry matter emanating from the defenders' works, and percolating through the intervening strata. Since that date, the water in the Brewery Well has also been unfit for use; and the pursuers have been entirely deprived of the supply of water which they previously obtained within their own premises. Subsequent mining operations in the defenders' premises have disclosed the fact that the strata in which the pollution exists are contaminated over a wide area. Owing to the character of the polluting matter, and the extent to which it has contaminated the strata lying between the pursuers' and the defenders' premises, the pollution will be of indefinite duration; and there is no reasonable prospect of either of the wells again becoming useful to the pursuers for brewing purposes. In addition to cleaning and regularly pumping the Brewery Well, it has been necessary, at considerable cost, to obtain a supplementary supply of water from other sources. This, however, is not suitable for brewing, and has to be treated before it can be used. The loss of the Brewery Well, in addition to the Stable Well, has deprived the pursuers of an essential element in their business, to their great loss and damage, and has substantially reduced the value of their brewery to break-up value, and destroyed their business. In any event, the cost to the pursuers, of acquiring and bringing in water from other sources, and treating it so as to make it sufficient for the purposes of brewing, will be very great, and will not be less than the sum sued for.

It is pleaded that, the pollution of the Brewery Well having been caused by the wrongful and negligent action of the defenders, they are liable to compensate the pursuers for the loss and damage thereby sustained by them; that, in any case, the defenders, being the authors of an *opus manufactum*, and having failed to prevent a noxious effluent therefrom from percolating into and polluting the pursuers' well, are liable in damages; and that the sum sued for being, in the circumstances, fair and reasonable compensation for the loss and damage sustained, the pursuers are entitled to decree as concluded for.

Defenders admit that the Brewery Well has become polluted by percolation from their works, and that the water in the well is unfit for brewing purposes; but they say that they have, by mining, located the source of pollution, and have removed it. They have also intercepted the pollution in the strata beneath the gas-works, which is confined to a strictly limited area; and they are in course of cleansing the strata. In consequence of their operations, the pollution has very materially decreased during the short period (about three months) which has elapsed since the defenders located the source of the pollution; and they believe and aver that the pollution is only temporary, and will, in a short time, come to an end. It is admitted that the pursuers have suffered loss through the pollution; but it is maintained that the sum sued for greatly exceeds the loss, and exceeds the total value of the business, even upon the assumption (which defenders deny) that the business has been destroyed.

It is pleaded that, in the circumstances stated, and in respect of the remedial operations which the defenders have executed, and are in course of executing, the action ought to be sisted, to await the result of the operations; that the damages claimed are excessive; and that, in any view, the defenders are entitled to credit for the sum already paid to the pursuers in name of damages.

The pursuers, in reply, deny that the pollution has been removed, and say that, even assuming the defenders have located the point in their ground at which the pollution was introduced—which the pursuers do not admit—the pollution has now saturated the ground to such an extent that it is practically impossible either to remove it or to effectually intercept it. Further, the defenders' operations have been of so intermittent and desultory a character that no reliance can be placed upon their proceeding to remedy it, even if such a remedy were ever practicable.

The case came before Lord Salvesen last Wednesday, for the adjustment of the record. Mr. Horne, for the pursuers, said he wanted

proof; but he understood the other side wished to discuss some points in the procedure roll. The proof he asked would necessarily be a preliminary one, as defenders were carrying out remedial operations.

Lord Salvesen said this and other questions would be very suitable for discussion in the procedure roll. There might be a proof afterwards upon the whole case.

CLAIM AGAINST THE BRADFORD CORPORATION.

Severe Judicial Comments.

Last Friday, at the West Riding Assizes, held in Leeds, Mr. Justice Grantham and a Special Jury had before them an action in which Mr. Albert Rendell, a draper, of Kirkgate, Bradford, claimed from the Bradford Corporation damages for negligence. It was contended that the Corporation workmen took up a flagstone in Albion Court, Kirkgate, for the purpose of repairing a gas-pipe, and replaced it so negligently as to allow water to percolate into the plaintiff's premises.

In opening the case, Mr. E. Tindal Atkinson, K.C. (who, with Mr. J. J. Wright, appeared for the plaintiff), said that in January, 1906, an escape of gas was noticed in the premises of the plaintiff; and there was some trouble in locating its position. A man from the Gas Department was sent for; and after visiting the premises he was led to believe that the escape came from outside. He accordingly went into Albion Court, and took up a flagstone. Eventually, he came to the conclusion that the escape was from the main in Kirkgate; and on this being opened, it was found to be broken. On the morning of Jan. 1, 1907—the day following the fall of a considerable amount of snow—it was discovered that water had come into the basement of Mr. Rendell's premises through the wall. The fixtures of the stationery department were injured; and the goods with which they were stored were ruined. It appeared that the man who took up the flag merely dropped it into its place; and from that time forward nothing had been done to secure it with cement. The aperture left round the stone, down which water could percolate, was considerable—equivalent in area to a space 6 in. by 7 in. At the time of the occurrence, snow had been swept up by the Corporation men into a heap, and put against his client's premises; and it was found that the water was coming through the wall, and was doing a great deal of damage. A message was despatched to the Water Department; and a man who was sent finally located the source of the water to be around the loose flagstone, and said that it should have been cemented. He stated, however, that the matter did not concern his office; and a communication was sent to the Streets Department. But nothing was done to secure the stone; and it was left in exactly the same position as before. As a consequence of the condition of the department of Mr. Rendell's shop where the damage was done, the goods had to be removed into another department; and this seriously interfered with his business.

Plaintiff gave evidence bearing out this statement. In cross-examination, he denied that the flagstone was interfered with by anyone in his employment in October, 1906. The flagstone was never moved at any time by anyone except the Corporation servants. He had a man named Priestley in his employment; but he would swear that he did not take up the flagstone. His carpenter poured tar down the crevices of the stone; but this was after the water had come in. He did not instruct any of his servants to pour water down the crevice before the date of the flood. At the time of the occurrence he had a man named Whittaker in his employ; and he poured some water down the crevice on the instructions of Mr. Robert Broster, a surveyor, who inspected the place after the flood. He denied that he had told his people to throw water over some stock he had bought at a sale. There was at that time a man named Holmes in his service; but Holmes did not under his direction dip a number of cardboard boxes into water after the flood. Holmes resigned the previous Monday, saying he wanted to be a free man. What he meant, plaintiff did not understand. Holmes did not remark that "he was going to tell the truth;" but he did say he could no longer remain with witness, "because the thing was preying upon his mind and his health." Witness arranged with a Mr. Dawson that if the Corporation sent a valuer to value the stock, Mr. Dawson would act for him and settle the matter. The Corporation, however, did not send a valuer. Witness had not himself put any water on his stock. In re-examination, he said that Holmes came to him, and stated that "he could stay with him no longer, because having to give evidence was preying upon his mind."

Mr. R. H. Blackburn, plaintiff's Manager, denied that any attempt was made to increase the damage by throwing water on the goods. Mr. W. Brayshaw, an auctioneer, stated that a quantity of damaged books and stationery were sold for £3 6s. 9d. If they had not been soiled, he thought they would have been worth over £25. Mr. Robert Broster, of Keighley, said that on Jan. 9 he saw the flagstone, and found that it had been removed, and that three of the joints had tar run into them; but there was an open joint ⅜ inches wide next to plaintiff's premises. It was not, in his opinion, pitch, but ordinary gas tar, which had been used. He made experiments which rendered it clear to him that there was a connection between the outside of the flag and the inside of Mr. Rendell's premises. These experiments included the putting of a quantity of red ink and water into the hole; and he saw a trickle come into the premises.

For the defence, Mr. W. J. Waugh, K.C. (who had with him Mr. T. R. D. Wright) remarked that he should call witnesses to show that Mr. Rendell gave instructions that things were to be put in among the damaged property which certainly were not damaged by the water which might have come through the aperture. He challenged Mr. Rendell with the fact that Mr. William Dawson, a perfectly respectable valuer in Bradford, had declined to go on with his valuation, expressing the opinion that it was not being honestly conducted; and it was part of the case for the defence that Mr. Rendell had said to another man that Mr. Dawson was not employed because he pretended to be too conscientious. Mr. Rendell's reply to this challenge had been that he denied giving instructions to Mr. Dawson; and he said that Mr. Dawson was not to be the valuer unless another valuer was appointed by the Corporation. But if no other valuer was appointed, it made it all the more necessary that Mr. Dawson should value for Mr. Rendell. It was most significant that Mr. Dawson had retired from the work. People did not nowadays refuse good business unless there was a valid reason for it. The Jury would have observed the way in which Mr. Rendell had given his evidence. They would have noticed that, with respect to the witness Holmes, who had been five years an honest man, Mr. Rendell was suspicious now that he had left his service. He should prove through Holmes that Mr. Rendell gave instructions on this valuation which were not honest, and that things were ordered to be put in which had not been damaged by any water which had come into the shop in the way alleged. He should call a number of other witnesses who would prove that when, in January, 1906, the flag was replaced, it was put back in cement, either the same day or the next day. The cement was brought, put upon the flag, and the work was properly finished off and made perfectly good. At that time, there was no corner broken off the flagstone in question; and he should be able to prove from the evidence of men who were in the habit of cleaning the windows of Mr. Rendell's shop that the flag some time in October had become loose. He should also be able to prove by the evidence of two witnesses that in the month of October Priestley himself took up this flag, and said he was looking for an escape of gas. He put in tar in order to make the flag good; and he should be able to call a man who went to the gas-works for a bucket of tar which was used for the purpose.

A service-layer named Pickles gave evidence that he went to Albion Court, to try and locate an escape of gas. He took up the flag in question, and finding that there was an escape removed some road setts. He then dug down to the main, and temporarily stopped the escape. He put back the earth and the setts and flag in a temporary condition. This was on Dec. 29, 1905. The next day, he finished the repairs to the gas-pipe, and temporarily put back the setts. The flag was laid again, in lime, and pointed up at the joints.

At this stage, Mr. Tindal Atkinson presented as a witness William Priestley, the plaintiff's carpenter, who had been sent for on the mention of his name during cross-examination. He denied that he had ever taken up a flag in Albion Court. Cross-examined, he admitted that last autumn there was an escape of gas, and he made a search for it. But he did not know that on the previous occasion the flag had been taken up; and he did not himself disturb it.

A number of witnesses were afterwards called for the defence. Mr. Charles Wood, the Gas Manager, gave evidence as to the reinstatement of streets after disturbance for repairs; and in cross-examination he said he believed the suggestion of the defence was that the flag stone was taken up for the express purpose of letting water on to the goods. Mr. Waugh, however, denied that such a suggestion had been made to him in his instructions. Mr. William Dawson, replying to Mr. Tindal Atkinson, said he did not know who authorized anybody to state in Court that he had formed the opinion that the claim was a fraudulent one. Percy Fisher and George Hind stated that they saw Priestley with a flagstone up; and Henry Benson (formerly in plaintiff's employ) said he heard Mr. Rendell give orders for the wrappers of goods to be damaged. This witness admitted that he made a statement to plaintiff's Solicitor, to the effect that a man named Whitney introduced himself in the street, and in reply to a question admitted that he represented the Corporation. He asked as to the manner in which the property had been damaged, and witness replied as well as he could. Whitney asked if he had seen Mr. Rendell pour any water or put any envelopes in water. Witness replied: "What a ridiculous question to ask!" Whitney said, "Why should a man set fire to his own shop? Why, to get the insurance money."

The final witness for the defence was Charles Holmes, who was formerly in the service of the plaintiff. He said that some of the goods sent away to be sold by auction were not damaged by the water from Albion Court. Acting on instructions, he wetted some of the cardboard boxes; and plaintiff stuck down some envelopes. The value of some of the stock was put up for the purpose of the case. He made out an inventory of the damaged goods, by order; but this was a false document. Mr. Tindal Atkinson: "So that whichever view is taken of you, you must be a scoundrel." In cross-examination, witness said that he had a long conversation with Whitney; and he gave a statement of the conversation to the plaintiff's Solicitor. He said that on the 8th of June Whitney met him in the street, and asked him if he was Mr. Holmes; and on his replying "Yes," said he was from Mr. Escott, of York. Mr. Tindal Atkinson drew the Jury's attention to the fact that this young man, who was employed in the Legal Department of the Town Hall, represented that he came from Mr. Escott, of York, who was a draper. Reading from the statement made by witness to the plaintiff's Solicitor, Counsel said that after some conversation about Mr. Escott, Whitney said he wanted to talk seriously to witness. He said, "I am from the police, and it is a criminal charge." Witness asked him what it was about; and Whitney said, "This claim that Mr. Rendell is bringing against the Corporation." Witness said, "You represent the Corporation?" and Whitney replied, "No; I am entirely for the police, though the Corporation may pay part of my salary." Whitney invited him to go into a public-house and have a drink; but he declined, though he subsequently accompanied him to the Midland bar, where he had some beer, which Whitney paid for. In conversation there, Whitney asked him, "Have you seen Mr. Rendell slop water about on his goods?" Witness replied, "What a ridiculous question to ask! As if any man would damage his own goods." Whitney said they had strong evidence that this was a got-up claim. Of course, this would be a criminal charge; and there was such a thing as conspiracy. The man who looked over the gate was as bad as the one who was in the field. Whitney asked him if he had arrived at the value of the goods. Witness replied that Mr. Rendell marked all the goods off, and he seldom saw invoices. Whitney warned him that if he gave evidence there would be shorthand writers taking down every word he said, and that his evidence would be used in any other case they might bring. Further questioned by Whitney as to Mr. Rendell's conduct towards his staff, witness said he had found Mr. Rendell a good master, and one who paid him a good salary.

This concluded the evidence; and Mr. Waugh then took a technical objection under the Public Authorities Protection Act that the action

had not been brought within six months of the damage complained of. Mr. Atkinson, in reply, maintained that the damage dated from the incoming of the water, and not from the original act which was the cause of it. The objection was over-ruled.

In addressing the Jury, Mr. Tindal Atkinson said that if the course of conduct which the witnesses had been submitted to were going to be pursued, a great many people would absolutely refrain from bringing actions against corporations. He thought the Jury would agree that it was disgraceful and most discreditable conduct on the part of an official of the Legal Department of the Bradford Corporation to act in the way in which it was shown he had done in this case. It was interfering with the administration of justice and intimidating witnesses—he put it on very high ground, but it was the true ground—and this interference ought to be punished as such. He thought that on the morrow, when the ratepayers of Bradford read an account of the case, they would blush for shame that such conduct could have been pursued by a Corporation official.

His Lordship, in summing up, remarked that the case as it was now presented was a very serious one indeed, because it had brought to light such conduct on the part of one of the most important public bodies—the Corporation of Bradford—as he had never heard of before. Continuing, he said: "We are all accustomed to speak of the tyranny of public bodies in dealing with individuals; but I am very glad to say I do not know that I have ever heard of their being guilty of absolutely dishonourable conduct, as we have heard in this case, and which has been proved up to the hilt. All I can say is that I have very great doubt whether if an application was made to me to commit Whitney to prison for contempt of court, it would not be my duty to send him to prison. I have never heard of such conduct on the part of a paid official." It was, he remarked, a most reprehensible thing for a person in the office of a solicitor to represent himself as being a detective paid by the police, getting up evidence and threatening people as to what would happen if they committed perjury, endeavouring to secure false evidence, then falsely instructing Counsel as to what the evidence they were going to bring forward was going to be, and altogether piling up a case of such dishonourable conduct as it had never been his lot to hear. Of course, now there could be no doubt as to what the verdict would be. Under ordinary circumstances, it would have been his duty to remind the Jury that unfortunately people in making claims often exaggerated those claims; and he should have suggested that the Jury would have been perfectly justified in discounting, and giving something less than, the plaintiff's claim. This was what he had intended at the close of the plaintiff's case to say to the Jury, because it was evident that there was no positive evidence of the exact losses. Now that the evidence had been given, and the conduct of this clerk had been proved, he should think that the only regret of the Jury would be that they could not give double what had been claimed, because it was clear that they could not believe a word of the evidence which had been called for the Corporation. They could not believe one of their witnesses, because where they found that a number of them had been tampered with, they did not know whether they were not all in similar case.

The Jury then returned a verdict for the plaintiff for the full amount claimed, £60; the Foreman stating that he was requested to say by his colleagues that they thoroughly endorsed the remarks which his Lordship had felt called upon to make upon the City of Bradford. He had himself been a business man in Bradford for thirty years, and it had pained him very much indeed. He felt, however, that the remarks had been thoroughly justified.

Judgment was entered against the Corporation, with costs; and Mr. Tindal Atkinson asked for, and was granted, an injunction, as the Corporation had not yet done anything to put the paving-stone right.

A Gas Company to Provide Electricity.

In the Second Division of the Court of Session at Edinburgh, on Wednesday last, the petition of the Shelmorlie and Wemyss Bay Gas Company, Limited, asking authority to the alteration of the Articles of Association of the Company, was considered. The Company was incorporated on Aug. 16, 1876, with the registered office at No. 33, Cathcart Street, Greenock. The capital was £5000, in 1000 shares of £5 each, all of which have been issued, and £2 10s. upon each share paid up. It is now desired to carry on the business of "electrical engineers, electricians, suppliers of electricity, manufacturers of electrical apparatus, and mechanical and chemical engineers; and to generate, produce, and supply light, heat, sound, and power by electricity, galvanism, magnetism, or otherwise; and other business or businesses convenient to be carried on with such business or businesses, or any of them, or any branch thereof; and for these purposes to acquire lands, works, property, and premises wherever convenient, patent rights, and other property." The capital, it was proposed, should be increased to £10,000 by the creation of 1000 new shares of £5 each. There was no opposition to the petition, which was accordingly granted.

Ryde Water Supply.—The Water Committee of the Town Council of Ryde, having completed their arrangements for securing an ample supply of water, recently invited the other members of the Corporation to Knighton, to view the water-works and the improvements made. They visited the engine-house, where much interest was evinced in the process for softening the water. In the course of an address by Mr. F. W. Randall, the Chairman of the Committee, he explained that the works had been undertaken on the advice of Mr. W. Whitaker, and had not entailed any increase in the rates. Alderman Groves, J.P., the ex-Chairman of the Committee, added details as to the work executed during the past ten years, including the laying of a duplicate main at a cost of £5423, providing a new engine and house at a cost of £4545, and ensuring the purity of their supply at a cost of £6200. The Resident Engineer (Mr. J. T. Harvey) was entitled to great credit for his supervision of all that had been done. Much satisfaction was expressed at the works, and a vote of thanks was passed to the Committee.

MISCELLANEOUS NEWS.

GASLIGHT AND COKE COMPANY AND METER-RENTS.

At the Meeting of the London County Council last Tuesday, the report of the Public Control Committee dealing with the proposal of the Gaslight and Coke Company to re-impose meter-rents [see *ante*, p. 181], came up for consideration.

Mr. Edward Smith asked whether the attention of the Chairman of the Public Control Committee had been called to the statement in the Press that, if this consent were given, at the end of twelve months the Gaslight and Coke Company would be able to charge meter-rents, and also further increase the price of gas.

Alderman H. T. Anstruther (the Chairman of the Public Control Committee) thought it would be difficult to answer a hypothetical question of this kind. He had not seen the statement referred to.

Mr. A. A. Allen, M.P., pointed out that the price of gas, as he understood it, was to vary by the Company in accordance with certain conditions which were laid down; but if they imposed meter-rents, they wanted to know whether the meter-rent would be taken into account in any future variation of the price of gas, or whether the meter-rent would remain. In addition to meter-rent, the price of gas might still go up.

Mr. Anstruther replied that, by the consideration which the Company were willing to give in return for this concession, the Company engaged not to raise the actual price for one year, and to lower the standard price 1d. for all time—effect to be given to this change in the next Act of Parliament. The meter-rent, of course, would remain once the Council assented to it. The Gaslight and Coke Company, loyally adhering to the undertaking which they gave to the Council before a Parliamentary Committee, came to the Council to ask for assent to their re-imposing meter-rents which they had waived some ten or twelve years ago. The Public Control Committee had given the most careful consideration to the question during the whole of one special meeting, and the greater part of another meeting of the Committee, and came to a unanimous conclusion, which was contained in the Committee's recommendation. The questions they had to consider when the matter came before the Committee were, in the first place, whether the Gaslight and Coke Company had good cause for the proposal that they made; secondly, whether the proposal was reasonable in itself; and, thirdly, whether it conflicted with any powers that they had under their Act of Parliament, or with any agreement that they entered into with the County Council. The Committee conceived it to be their duty to see that no undue hardship should be imposed upon any consumer; and they had to inquire whether any valuable consideration was to be given to the consumers in return for the concessions they were requested to make. From the scale of prices submitted by the Company, it would be seen that, on a comparison of the figures furnished by the Comptroller, the majority of consumers of gas under the proposals submitted by the Gaslight and Coke Company would be placed in a better position by the imposition of meter-rents, because it was perfectly clear that the only alternative open to the Company was to impose an extra 1d. per 1000 feet in the price of gas. The Company were not responsible for the rise in the price of coal; and it was perfectly evident that with the increased cost of production, they were entitled to look to some further source of revenue, in order to enable them to supply their customers without actual loss. It was also clear that it was within the Company's statutory powers to re-impose meter-rents, although they gave an undertaking that they would not re-impose them without coming to the Council for consent. To this undertaking, they had loyally adhered; and he might mention that they were very much indebted to the General Manager of the Company for his attendance before the Committee, and his very lucid explanations of the whole bearings of the case. Then they had to consider whether any undue hardship was to be imposed upon consumers. From the table it would be seen that the whole of those who consumed gas by automatic meters were untouched by the Company's proposals; whereas the imposition of an additional 1d., or whatever sum it might be, on the price of gas would undoubtedly have affected them adversely. They were more than 50 per cent. of the whole of the consumers, and might be taken to represent, if not the poorest, at least a very large number of the very poorest classes of consumers. Regarding 3-light meters, it would be seen that the consumers who were supplied by this size of meter were not in quite so favourable a position under the proposal which he recommended the Council to adopt. His inclination, when the matter was before the Committee, was to refer it back, as it were, to the Company; to ask them if they would not be willing to amend their charge of 2s. per annum, or 6d. per quarter, by the reduction of 1d. per quarter, which would bring it to 5d. a quarter, or 1s. 8d. per annum. But, as the matter was rather pressing, and the finding of the Council was to date from Midsummer last, he did not care to do this. He had the assurance of the General Manager of the Company that, if such conditions were imposed, they would be at once accepted by the Company. There only remained the question as to what valuable consideration they were to receive in return; and the Company proposed that, in the first place, they would not raise the price of gas during the current year—that was before Midsummer, 1908; and secondly, they agreed that the authorized dividend under their statutory powers should be calculated upon a price of 1d. per 1000 cubic feet higher than it was at present, the effect of which was to reduce the standard price by 1d. He thought those who had studied the question would realize that, if an agreement to this effect were at once come to, and an undertaking obtained that this provision would be inserted in the very next Act of Parliament the Company secured, it could be conclusively proved that a permanent benefit had been secured to the consumers of gas in London.

Mr. I. Salmon expressed the opinion that the proposal was the fairest for all classes of consumers, with the exception of those using the 3-light meter, who suffered to the extent of nearly 5d. What

principally influenced the Committee in coming to a decision was that 261,000 automatic meters were used by the working classes who took their supply from the Company; and if the price of gas were increased by 1d. per 1000 feet, they would pay not only the increased price, but would still be paying meter-rent, because, under the Special Act upon which these charges for automatic meters were made, they paid a meter-rent of 9½d. per 1000 feet. He moved, as an amendment to the recommendation, that the following words be inserted after the word "submitted" on line 2, "except that the annual meter charge for 3-light meters shall not exceed 1s. 8d. and."

Mr. CYRIL S. COBB seconded the amendment.

Mr. EDWARD SMITH desired the Chairman of the Public Control Committee to give a statement that his hands would not be tied when the Company went to Parliament for their next Bill. The City paid no meter-rent. By a Special Act of Parliament they were excluded from such a charge. It was a very complicated matter; and he wished there should be preserved to the Council full liberty to take any action to attempt to remove this restriction whenever the Company should go to Parliament, in compliance with the undertaking he understood they had entered into. This assurance being given by the Chairman, that they were entirely free not to still further perpetuate this side of the matter, he did not know that he should oppose it. By passing a thing like this hurriedly, affecting one particular class, they might inflict very great injustice upon another, and an equally important, class of the community. He therefore suggested to the Chairman of the Public Control Committee, that he should allow it to stand over until they got an undertaking on the part of the Company.

Mr. ALLEN said they were specifically told that it was necessary for the Company to increase their income. They seemed to be going about the increase in rather a curious manner, because they desired to charge a meter-rent which was the equivalent of ¾d. per 1000 feet on the price of gas; and in exchange for this they were going to raise the bar under which they got it passed before, which could increase their dividend by 1d. per 1000 feet. It seemed to him that, so far from getting any benefit out of it—charging ¾d. in this particular manner—they were putting this extra 1d. bar before they could increase their dividend.

Alderman W. S. SANDERS said when a company looked as if they were giving away something, he got very suspicious. It seemed to him that the Company wanted to get an increase of dividend, and a permanent increase of dividend, in a way that would not call the public attention to the increase as an increase in the price of gas would. Whether the consumer suffered immediately or not, he believed the most straightforward way, if the Company wanted to make more dividend, would be to put up their price for gas, because although apparently the consumer would not suffer the first year, he wanted to know the effect of these charges in the future. It seemed to him what the Company wanted was to have a minimum of income which would not be variable—that was to say, they could always depend upon £60,000, which would never vary except in an upward sense. If there was going to be a variation, let it be a true variation all round; let the people know what they had to pay for their gas in the future, as much as they knew in the present year.

Alderman ANSTRUTHER accepted the amendment of Mr. Salmon and Mr. Cobb, because it gave effect to an undertaking which he had been able to secure in negotiations with the Company. On the question raised by Mr. Sanders, he did not know that he had fully appreciated the position. As it appeared to him (Alderman Anstruther) no increase in the dividend could be arrived at, as determined by the standard price—the sliding-scale above and below the standard price—without a reduction in the price of gas; and therefore it could not be truly said that the object of this action on the part of the Company was merely to increase their dividends. Their object, as he understood it, was that the Company should place themselves upon the same footing as other gas companies in London, who were in the position of charging meter-rents, in order that their price to consumers might not compare unfavourably in their published statistics and balance-sheets and so forth which was available to the people of London. So far as the ultimate or possible increase, after the termination of the year 1908 was concerned, the Council would understand that the undertaking that the Company were giving them, to raise the point on which their dividend should be calculated, was one that was to be for all time; and the engagement not to increase the price of gas was only in operation for one year. The fact that the City was excluded weighed with some of them when they first came to consider this question in the direction of advising the Council to refuse the application of the Company, in order that every citizen of London might be put upon the same footing; and this point was discussed by the Public Control Committee. No reference to it was made in the report, because they did not consider it to be their duty to go beyond the immediate question which was submitted to them for consideration. He had an assurance from those who were responsible for the management of the Company that, upon the next occasion that they went to Parliament, it was their intention to ask for powers to place the whole of the consumers, whether they be in the City of London or in the County of London, upon the same footing.

The CHAIRMAN put the amendment to the Council; and it was agreed to.

Sir J. W. BENN, M.P., then moved that the report of the Committee be referred back. It had been explained that this was merely a re-adjustment of prices in order to enable the Company to take their place side by side with other gas companies; but he was a little bewildered, because it said "The Company now states that, in consequence of the recent increase in the price of coal and oil, it is faced with the necessity of increasing its income, and one way which suggests itself is the re-imposition of this rent." He thought it was quite clear from this that somebody had to pay an additional sum. He could not fully understand the matter; and for the purpose of getting more light on the subject he moved that it be referred back.

Mr. ALLEN seconded. It was a somewhat difficult report to understand. So far as he could make out, the alternative seemed to be the imposition of meter-rents or the imposition of an additional 1d. per 1000 cubic feet on the price of gas. They were told that for every additional 1d. of price per 1000 cubic feet of gas the consumers would have to pay something like £80,000 per annum. This meter charge, which was equivalent to ¾d. per 1000 cubic feet of gas, would produce only £60,000. Then also, in addition to the meter-rent, the Company would be getting a larger charge for the gas they supply on the south side of the Thames.

Alderman ANSTRUTHER said without any reference to them at all, the Company had this power already. They equally had the power to increase the price by any sum that they pleased on the north side of the river.

Mr. ALLEN said that they would, in fact, get rather more than 1d. extra per 1000 cubic feet. The matter was so extremely difficult that he could not believe a Company of this kind were bringing up the recommendation with no object of serving their own ends. He did not in the least see where the interests of the consumer came in.

Sir JOHN M'DOUGALL said the practical result would be that there would be a special charge for meter-rent in every case. Supposing this were 2s., if somebody had to pay 1s. 6d. as an increased charge for gas, he would not be nearly so troubled and annoyed as having a new charge of 3s. put upon him. The Company would say "Oh, yes, this has been done with the consent of the London County Council." The Company had for some reason or other agreed not to make a meter charge. Now they were going to assent to them doing it. It would cause commotion among every one of the people that the London County Council were putting on a new charge. They ought to leave the Company to go to Parliament, and the Council should not forego something the Company assented to do some time previously.

Alderman ANSTRUTHER deprecated the reference back of this question. He did not believe that any further light could be shed upon the matter a week hence. With regard to what Sir John M'Dougall had said, he admitted at once that his first impression was to take his view, because it was absolutely open to the Company to-morrow to put up the price of gas 1d.; and if they could stand the racket of the lower dividend, to put it up by 3d. per 1000 feet. But after the most careful consideration, the Committee were unanimously of opinion that the easier method for the consumers, and particularly for the great body of the poorer consumers, especially automatic consumers (amounting to over 50 per cent. of the customers of the Company), was to waive their right to prohibit as it were the imposition of the meter-rent, as it would be easier from the point of view of means and substance of the poorer consumer.

On a show of hands, the reference back was lost; and the amended recommendation of the Committee was agreed to.

THE PAST YEAR AT MANCHESTER.

Another Satisfactory Increase in Gas Consumption.

We have received from Mr. Charles Nickson, the Superintendent of the City of Manchester Gas Department, the report and accounts of the Gas Committee for the year ending March 31; and from them the following particulars have been gathered. The report bears the signature of Alderman R. Gibson, the Chairman of the Committee.

The quantity of coal and cannel carbonized (including the equivalents of enriching materials) was 503,693 tons, as compared with 484,249 tons in the previous year; the quantity of gas made per ton being 11,099 cubic feet, against 10,976 feet. The quantity of gas sent out from the works (5,589,906,000 cubic feet) shows an increase of 270,071,000 feet, or 5·08 per cent., as compared with an increase of 321,379,000 feet, or 6·43 per cent., the preceding year. The quantity of carburetted water gas produced during the year was 1,191,215,000 cubic feet, as compared with 1,194,041,000 cubic feet the previous year. In the production of this gas 2,930,081 gallons of oil and 24,526 tons of coke were used, as against 3,531,282 gallons and 22,917 tons respectively for the year ending March, 1906. The illuminating power of the gas sent from the works, as tested by the "Metropolitan" No. 2 burner, was equivalent to 17·67 standard sperm candles. The unaccounted-for gas was 3·14 per cent., which compares with 3·20 per cent. for the previous year.

The number of consumers on March 31 was 166,061, of whom 21,017 were outside the city. The previous year the number was 160,113, of whom 19,389 were outside the city. The total increase was thus 5948. Of the total consumers, 54,705 use prepayment meters. This compares with 52,006 in the previous year—an increase of 2699; and of this increase 2087 have been fixed in the city and 612 in the out-townships. The quantity of gas passed by these meters was 474,582,000 feet, an increase of 47,750,000 feet, or 11·19 per cent., on the previous year. The meters have been inspected once in every five weeks; and the amount collected during the year was £66,530 13s. 3d. This is represented by 15,967,359 pennies, weighing 142 tons 11 cwt. 1 qr. 7 lbs. The number of gas-cookers and other appliances owned and fixed by the Committee at March 31 was 36,214, compared with 29,760 for the year ending March, 1906. The total quantity of gas that was consumed by cookers is estimated at 504,000,000 cubic feet—being an increase of 78,000,000 feet, or 18·31 per cent., on last year's figures. There have also been fixed 28,452 grillers in connection with prepayment and small ordinary meters. About 39 per cent. of the consumers now have the free use of a cooker or griller. On March 31 last the number of gas-engines in use was 1732, as compared with 1775 in the previous year. The quantity of gas consumed by these engines was 416,227,000 cubic feet—an increase of 2,138,000 feet, or 0·51 per cent. The cost of coal, cannel, and oil per ton carbonized was 9s. 11·81d., as against 10s. 4·74d. for the previous year, a reduction of 4·93d. per ton, which, on the total carbonization of 503,693 tons, amounts to £10,347.

The total income was £730,902, against £699,566, and the expenditure £564,304, against £566,692. The gross profit on the year's working was £166,598. The sum of £46,474 was paid for interest on loans, &c. The net profit therefore amounted to £120,124, as compared with £90,004 in the previous year. This sum, together with £8782 transferred from reserve—making together £128,906—has been appropriated as follows: To the sinking fund for redemptions of loans, £56,111; paid over to city fund, £60,000; extension of carburetted water-gas plant, £17; extension of the Whitworth Street West depôt, £2518;

Gaythorn works (land), £318; general extensions (wages), £8655; purchase of consolidated 4 per cent. stock for cancellation, £1286.

During the year the horizontal retort settings in the second section of the No. 2 retort-house at the Gaythorn station, together with the building and the river covering, have been removed to make way for the completion of the installation of inclined retorts. A section of water-sealed purifiers, consisting of eight boxes, erected forty years ago, with an area of 3600 square feet, have been removed and replaced with four rubber-sealed purifiers of an area of 7500 square feet. A new installation of West's compressed-air stoking machinery in the "B" and "C" retort-houses at Rochdale Road has been completed, and is working satisfactorily. Various other alterations and extensions at the different works have also been taken in hand. The total length of mains now laid is 1,581,261 yards, or 898¼ miles and 341 yards; being an increase of 18¼ miles and 360 yards during the year. The number of public lamps within the city is 18,139, and outside the city 2224—a total of 20,363, of which 14,514 within the city are fitted with 20,976 incandescent burners.

The following are the principal items in the accounts:—

REVENUE ACCOUNT.

INCOME.

Gas-rental—						
Ordinary meters					£492,349	2 3
Prepayment meters					66,530	13 3
Public lamps					42,681	16 9
Residual products—						
Coke	£66,924	13 5				
Tar	26,897	3 3				
Sulphate of ammonia	34,388	13 10				
Carbon	331	6 1				
					128,541	16 7
Rents of cottages, &c.					798	15 11
					£730,902	4 9

EXPENDITURE.

Manufacture—						
Cannel, coal, and oil (including cost of unloading, &c.)	£251,460	9 1				
Coke, water, &c. (carburetted water gas)	8,906	4 6				
Carbonization (wages)	45,607	6 0				
Purification (less sales of spent material, £4791 13s. 9d.)	2,898	17 0				
Retorts, fire-bricks, &c.	6,115	11 10				
Repairs and maintenance of works, &c.	41,644	17 9				
Salaries of Engineer and works staff (less proportion transferred, £1240 9s. 4d.)	5,922	14 8				
	£362,556	0 10				
Provision for renewal of works plant	20,127	0 0				
					£382,683	0 10
Distribution—						
Repair and maintenance of mains, services, meters, and stoves	£33,758	3 4				
Salaries (less proportion transferred, £300)	27,255	9 5				
	£61,013	12 9				
Provision for renewal of distribution plant	41,821	0 0				
					102,834	12 9
Rents, rates, and taxes					55,174	8 7
Management—						
Salaries	£15,139	14 1				
General charges	4,875	9 9				
					20,015	3 10
Law and parliamentary charges					130	0 0
Subscriptions and donations					2,222	4 1
Bad debts					1,244	5 5
					£564,303	15 6
Balance carried to profit and loss account					166,598	9 3
					£730,902	4 9

The accounts are followed by the usual appendices, furnishing particulars in regard to the progress of the undertaking.

Appendix A is a comparative statement of the gas transmitted from the works in the daytime and during the twenty-four hours, for the past two years. Summarized, the figures are as follows:—

	Daytime. Cubic Feet.	Twenty-four Hours. Cubic Feet.
Year ended March 31, 1907	1,779,779,000	5,589,906,000
Do. Do. 1906	1,670,277,000	5,319,835,000
Increase	109,502,000	270,071,000

	Cubic Feet.
Gas transmitted from the works	5,589,906,000
Do. accounted for	5,414,446,000
Loss (by condensation and leakage)	175,460,000

or 3·14 per cent.

In Appendix B, particulars are given as to the results of the working from March 31, 1888, to March 31, 1907. The table contains statistics as to the number of tons of coal and cannel carbonized, the total make of gas, the percentage unaccounted for, the yield per ton of coal, the illuminating power of the gas, the quantity of residual products, &c., each year in the above-mentioned period. The particulars for the past financial year are as follows: Coal and cannel carbonized, 503,693 tons; gas made, 5,590,460,000 cubic feet; yield per ton of coal carbonized, 11,099 cubic feet; illuminating power, 17·67 candles; quantity sold, 5,277,615,000 cubic feet; quantity sold per ton, 10,478 cubic feet; percentage of output unaccounted for 3·14; coke for sale, 199,133 tons; do. per ton of coal, 10·05 cwt.; make of tar, 26,918 tons; do. per ton of coal, 11·54 gallons; ammoniacal liquor (10-oz. strength), made, 11,303,378 gallons; do. per ton of coal, 28·53 gallons; sulphate made, 4021 tons; do. per ton of coal, 24·50 lbs.

Appendix C shows the number of stoves and of each size of meter in use during the year in the city and out-townships. At the close of the past financial year, there were 30,705 stoves on hire within, and 5509 beyond, the city—together 36,214, compared with 25,078 and 4682 (together, 29,760) at the corresponding date in 1906; so that there was an increase of 6454. The number of meters in use was 166,061 in 1907 and 160,113 in 1906. There was last year a net increase of 5948 on the number for the preceding year. The number of prepayment meters in use on March 31 last was 54,705—an increase of 2699 on the number at the close of the preceding year.

From Appendix D, we learn that the gas-mains laid last year within the city extended to 30,311 yards, and beyond the city to 11,672 yards—being 23⅝ miles and 183 yards. The mains taken up were 8011 and 1492 yards respectively—a total of 9503 yards, or 5¼ miles and 263 yards. The total net increase during the year, therefore, was 32,480 yards, or 18¼ miles and 360 yards. The total length of mains at March was 1,581,261 yards, or 898¼ miles and 341 yards.

Appendix E is an abstract of the capital, revenue, and profit and loss accounts. It shows (*inter alia*) the amount of gross profit made from the gas undertaking, and the mode of its appropriation, also the amount of borrowed money owing, excess of assets, &c., from March 31, 1887, to March 31 last. The figures for the past financial year are as follows: Gross profit, £167,950; net profit, £120,124; contributed to sinking fund for redemption of debt, £56,111; paid over for improvement purposes and city fund, £60,000; applied in extension of works, £12,796; borrowed money owing, £1,235,295; and excess of assets, £1,537,417. From June 24, 1843, the date when the works were taken over by the Corporation from the Commissioners of Police, the gross profits on the gas undertaking have amounted to £5,753,609, out of which £1,365,946 has been paid for interest—leaving a net profit of £4,387,663. Of this total, £1,346,505 has been placed to the sinking fund, £2,479,383 has been handed over to the Improvement Committee and added to the city fund, £329,201 has been paid for street lighting (making £2,808,584 used in relief of the rates), and £183,434 applied to extensions of works.

EXTENSION OF THE HARROW GAS-WORKS.

Compensation for Land and Property Acquired.

On Wednesday last, a claim against the Harrow Gas Company, for compensation for disturbance, came on before the Under-Sheriff of Middlesex and a Jury at the Guildhall, Westminster.

Sir EDWARD BOYLE, K.C., M.P., and Mr. DENNISS represented the claimant (Mr. Hall, dairyman and farmer, of Harrow); Mr. BALFOUR BROWNE, K.C., and Mr. PADDON appeared for the Company.

Sir EDWARD BOYLE, in opening, intimated that the claim was in respect of Eastcroft Farm, Harrow—a freehold of about three acres, with farmhouse and buildings and several cottages upon it. The farm adjoined the property of the Gas Company, who, requiring to extend their works, had taken compulsory powers to purchase the claimant's holding under a recent Act of Parliament. Mr. Anthony Hall, the claimant, in addition to being the freeholder of Eastcroft, also rented 109 acres adjoining the farm, for the purposes of pasturing cows, &c. He had been tenant of the land for thirty years; and though his lease was up on Sept. 2, 1908, there was no doubt that he would be again accepted as a tenant. In 1900, the claimant sold the Gas Company a piece of land adjoining their works at the rate of £1000 an acre, and, in addition, Mr. Hall reserved a strip of frontage adjoining the Gas-Works lane. They also built a substantial boundary wall, and further agreed to drain the lane. He mentioned this as an indication of the value of the land surrounding. To-day there was a station near. The land was ripe for building purposes, and was becoming daily more valuable. The claimant kept 50 or 60 cows, and made £1000 a year out of his business, which, during the last five or six years, had increased to the extent of 50 per cent. in consequence of the rapid growth of the district. If claimant was deprived of his farm and buildings, the land he rented would be no use to him. He would have to dispose of his business, and thus sustain very considerable loss. The rental of the freehold house and farm buildings, together with five cottages and land, was estimated at £156 per annum, which, at 20 years' purchase, was worth £3120. Then there was about three-quarters of an acre adjoining the gas-works (which they valued at the rate of £1000 an acre), £681. There was also the strip of frontage to the Gas-Works lane, £100; for fixtures, £26 7s. was claimed; enforced sale of stock, &c., £524; and other minor things made the claim under the item of the farm, £5006. In consequence of the sale of the farm, claimant would lose his business; and for this he asked three years' purchase, at the rate of £1000 per annum profit, £3000—making the total claim just over £8000.

Mr. *John Strachan*, the Clerk to the Harrow Council, was called, and gave evidence as to the development of Harrow. In 1901 the area of Harrow was 1000 acres, and the population numbered 5725; in 1901 it had increased to 10,220, and the area to 2197 acres. In 1906 the population was 13,697; and they estimated it now at 14,000.

By Mr. BALFOUR BROWNE: The area had been doubled at the same time as the increase of population indicated.

Mr. *W. Flint*, a surveyor, stated that he had examined the property of the claimant, and considered the land valuable for building purposes. He valued the farm and adjoining buildings and cottages at a rental of £156 per annum, which, at twenty years' purchase, gave £3120; freehold building land between the house and lane adjoining (2 roods 29 poles), £681; a strip of frontage, 150 ft. by 4 ft. 9 in. average width, £100—total £3901. Add 10 per cent. for compulsory sale, £390; grand total, £4291. Loss on 109 acres rented, half-year's rent £164 5s.; loss for forced sale of stock, £275, trading utensils, &c., £149 15s., loss on hay, &c., £100, total £524 15s.; loss on having to sell the business, £3234—making a total of £8240. He was of opinion that if the farm was taken, claimant would be unable to carry on his

business, and would have to dispose of it. The land he rented would be of little value to him without the farm, which was essential for his business. Claimant would be unable to find suitable land for his cows anywhere near, on account of it being held for building purposes.

In cross-examination by Mr. BALFOUR BROWNE, witness said that when the farm was taken from claimant there was plenty of other land in the district to be sold, but it was for building on. It was very expensive to buy such land for dairy purposes. The area of the claimant's freehold land was 2 acres 2 roods 29 poles; and he considered the taking of this would spoil his business. He knew that the claimant had recently purchased another farm in the district; but it was 1¼ miles from the existing one, and was unsuitable for dairy purposes. He was aware that when the Company gave £1000 an acre for the previous plot of land, they had not any compulsory powers. He thought the strip of frontage worth something. He might build a high wall on it. As the place developed, this might make an advertising station. If the lane were deducted from the area of land, it would make no difference to his valuation. He thought the piece of land adjoining the site belonged to Mr. Chapman, who was "someone in connection with the Gas Company."

Mr. BALFOUR BROWNE: Supposing we reinstate you on the land adjoining the site, all your claim for loss of business goes, does it not?

Witness: If they reinstated claimant.

In further examination, witness said, in his opinion, it would take £1000 to reinstate claimant in so far as the farm buildings were concerned, without considering the farm and cottages. The latter were of wood; but he had valued them at twenty years' purchase.

Mr. *Howard Martin*, an auctioneer and surveyor, gave similar evidence; and his estimate of the value was £7701.

After an adjournment,

Sir EDWARD BOYLE announced that the parties had arrived at a settlement. The Company had agreed not to take the whole of the land at once, thereby giving his client an opportunity of realizing his stock at the end of his lease of the 109 acres of land he was now renting, the lease of which was up on Sept. 29, 1908; and his clients had agreed to accept a verdict of the Jury for £4500. Of this sum, £2000 was to be paid at once, and the remainder on the completion of the purchase.

Mr. BALFOUR BROWNE: On proof of title?

Sir EDWARD BOYLE: That is usual.

A verdict was returned accordingly, costs to follow the event.

INSURANCE OF GAS-WORKS EMPLOYEES.

Report by Mr. W. R. Herring.

In accordance with instructions, Mr. W. R. Herring, the Chief Engineer and General Manager to the Edinburgh and Leith Corporations' Gas Commissioners, has presented a report to the Commissioners on the subject of their liability under the Workmen's Compensation Acts. The point specially considered by Mr. Herring was whether it would be advantageous for the Commissioners to insure their workmen with some recognized association to cover all claims at common law or under the Employers' Liability Acts or the Workmen's Compensation Acts; or, on the other hand, to continue to follow the policy which has been practiced during the past ten years, of meeting all claims arising under such Acts out of the current revenue. The practice hitherto followed in dealing with employees who have had the misfortune to meet with an accident is to pay half wages from the time of the accident happening, notwithstanding the fact that there was no obligation under the Workmen's Compensation Act to take into consideration the first fourteen days of such accident. The new Act, however, provides that no compensation shall be payable in respect of any injury which does not for one week disable the workman from earning full wages. If incapacity, however, lasts two weeks or more, the liability is from the date of the accident, and does not exceed 50 per cent. of the former wages. Mr. Herring prepared a table setting forth the total wages paid during the past ten years, the amount paid as compensation for accidents for each year from the time of the accident happening, the rate per cent. of wages that the sums paid came to each year, and the maximum and minimum number of employees during the winter and summer months, accompanied by remarks relating to particularly bad accidents recorded against any year. By totalling the claims, he showed that the compensation paid under the Acts amounted to £1114 5s. 3d., or an average of 2s. 9d. per cent. of the wages paid. The recent amendment to the Workmen's Compensation Act brings an additional number of the employees within its scope, totalling 180 above those recorded in the table. After offering some remarks in regard to the question of the liability of gas-works employees who meet with an accident, and pointing out that the Commissioners' employees do not run any unusual risks, he came to the conclusion that, in view of the fact that the rate at present asked for insurance of gas-works employees is 17s. 6d. per cent. of wages, and 12s. 6d. for some others, such as meter readers, &c., whereas it has only cost, during the past ten years of somewhat exceptional circumstances, 2s. 9d. per cent. of wages paid, the Commissioners will be wise to continue in the future as they have done in the past, and bear the burden, and meet out of the current revenue from year to year any claims arising as the result of accident.

Water-Works Scheme for Birr.—Mr. A. G. Price, Engineering Inspector of the Local Government Board, last Tuesday held an inquiry into an application by the Birr Urban District Council for a loan of £10,200 for the purpose of carrying out a scheme of water-works for the town. It transpired that the War Office had agreed to take a supply of 15,000 gallons a day for the barracks at Crinhle, for a period of fifteen years, at the rate of 10s. 6d. per diem. Mr. Francis Bergin, Engineer to the Council, estimated the number of gallons that would be required per day at 110,000, and the total cost at £10,195.

EUROPEAN GAS COMPANY, LIMITED.

An Increased Bonus—Changes in Works' Management.

The Annual General Meeting of the Company was held last Tuesday, at the London Offices, Finsbury House, Blomfield Street, E.C.—Mr. R. HESKETH JONES in the chair.

The SECRETARY and GENERAL MANAGER (Mr. W. Williams) read the notice convening the meeting, and afterwards the Directors' report and the accounts. The former was as follows:—

The consumption of gas during the past year shows, in the aggregate, the satisfactory increase of 3½ per cent. With the exception of Caen, all the Company's stations have shared in this increase, which was largest at Boulogne, Rouen, and Sotteville (6 to 9 per cent.), and varied from 2 to 4 per cent. at Bolbec, Amiens, Havre, and Nantes.

The returns from coke, tar, and sulphate all show an improvement; and there has been no advance in the cost of coal—the supply having been assured under contracts made two years ago. In making new contracts, however, the Board, in common with the Directors of all other gas undertakings, have had to submit to higher prices.

Reference has been made in recent reports to the increasing business of the Company at Nantes, where the Company's concession runs until December, 1946. Having regard to possible future requirements there, the Directors have taken advantage of a favourable opportunity to purchase some property adjoining their gasholder station. It includes land and buildings which, later on, will doubtless prove a useful acquisition to the Company.

The unexpired concessions for the seven towns lighted by the Company average 28 years.

The satisfactory state of the Company's business and of its prospects generally, appeared to the Directors to warrant an increase in the interim dividend. Accordingly the shareholders received on Feb. 1 last a dividend of 5 per cent., instead of the usual 4 per cent. which had been paid for many years past. The Board propose to maintain the dividend at the same rate as in previous years, but to declare a bonus of 2 per cent., instead of 1 per cent.—thus increasing the total return to the shareholders for the year by 1 per cent. The Directors therefore recommend the payment of a dividend of 20s. per share on the fully-paid shares, and 15s. per share on those £7 10s. paid, less the interim dividend of 10s. and 7s. 6d. per share respectively paid on Feb. 1 last; also that a bonus of 2 per cent. be paid on all shares according to the amount paid thereon, subject, however, to a deduction for French stamp and transfer duty of 1s. 1d. per fully-paid share, and 10d. per share £7 10s. paid, in respect of all shares held in France.

Notice has been given that two Directors (R. Hesketh Jones, Esq., and H. E. Jones, Esq., M.Inst.C.E.), and both Auditors (J. Reeson, Esq., and A. T. Eastman, Esq.) retire from office at this meeting; but, all being eligible, they offer themselves for re-election.

The CHAIRMAN, in moving the adoption of the report and accounts, said he did not intend to detain the shareholders but for a few minutes, for the satisfactory state of the accounts and report which had been read must be as gratifying to them as they were to the Directors. One might say that the year under review had been a "record year," and had enabled the Board to write down the Company's investments and many other items very liberally, thus relieving the finances of future years, and so providing, as it were, for at least some portion of the future increased cost of coals. One might also venture to state that the Directors saw no reason why this year's rate of dividend and bonus should not be maintained for the year ending March 31 next. It might be mentioned that the 2 per cent. bonus was not paid out of the manufacturing profits, but represented the dividends received on the investments of the reserve and redemption funds. On March 31, there were 73,139 consumers on the Company's books, spread over 534 miles of mains; being an increase of 2613 consumers and of 10 miles of mains, thus showing the progressive character of the Company's business. Although his remarks were few, it must not be thought that there had been no troubles to meet during the year; but thanks to their General Manager and to the Managers of their several works, the difficulties, as they had arisen, had been surmounted without friction either with the workmen, the consumers, or the several governing authorities in France. At the present time, it might be said that they were living in peace, and their endeavours would be to maintain amicable relations with all with whom the Company might have to deal. There was one matter to which he might allude, and which did not pertain to the period under review. For some months past, the health of M. Marchal, their esteemed Manager at Nantes, had been failing. The importance and development of the business there rendered it necessary to have, not only a devoted and skilled Manager, but one whose bodily health was good. M. Marchal, feeling this, had just resigned, and had this month been placed on the pension list. He was succeeded by M. Gustave Gautier from Rouen, one of their most experienced Managers. This has necessitated changes in management at Rouen, Boulogne, and Amiens, which were in course of being carried out. It was satisfactory to know that these changes could be effected without going outside their own technical staff. He concluded by moving that the report and accounts be received and adopted.

Mr. E. FELIX WHITE seconded the motion.

Mr. H. A. RIGG remarked that he noticed part of their investments were in South Nigeria stock. Was that a stock guaranteed by the British Government?

Mr. H. C. SMITH said it was not. The security, however, was good; it was a Crown Colony, and the stock a trustees' investment.

The motion was unanimously carried.

On the proposition of the CHAIRMAN, seconded by Mr. N. E. B. GAREY, a dividend and increased bonus, as recommended in the Directors' report, were declared.

Mr. JOHN COPPEN proposed, and Mr. H. E. JONES seconded, the re-election of the Chairman as a Director. This was agreed to; and a further resolution, moved by the CHAIRMAN, and seconded by Mr. GAREY, also returned Mr. H. E. Jones to the Board.

Mr. H. E. JONES, in the course of his acknowledgment, said he should like to say that the question of the investment of the Company's funds was a matter of very grave discussion on the part of the Board; and they almost invariably sought trustee investments, such as, while they did not give them the fattest return, gave them absolute security.

The retiring Auditors (Mr. J. Reeson and Mr. A. T. Eastman) next came up for re-election. The former was proposed by Mr. GOLDSMID

and the latter by Mr. RIGG; and Mr. E. F. DONNE seconded both. The propositions were unanimously carried.

The CHAIRMAN moved that the thanks of the meeting be passed to the officers and staffs in London and abroad. He spoke of Mr. Williams as an admirable officer—very cautious and very much attached to the interests of the Company; and with reference to the other members of the staff in London, he said he could not speak too highly of them. Regarding the staffs abroad, he thought the fact already mentioned that, in making their re-arrangements for the management of their works, it was not necessary to go outside their own staff for officers for the vacancies, was high testimony to the ability of their technical staff. To speak of anyone of them individually would be perhaps invidious on his part, because all their officers were most efficient in their management and tact.

Mr. H. E. JONES said that he had the greatest pleasure in seconding the vote, because the staff of the Company was filled, in its most important places, by men of education and experience. Especially was this so of the engineering staff. Their men were trained in engineering, apart from gas engineering, before they came to the gas department; and they worked in a most conscientious manner. In fact, having to do with a few gas undertakings in this country, he often said he wished there was the same scrupulous care here over the small details, particularly in the matter of residuals. The precision and care with which every small thing was turned to account was most remarkable; and to the different matters of extension from the engineering point of view, there was devoted not only competence, but great care and study. It was, indeed, a pleasure to see a staff so efficient. He should like to say, too, with what personal regret he had learned of the retirement of M. Marchal, who, though failing in health, was one of the most competent and energetic gas engineers he had ever met with.

The motion was heartily agreed to.

Mr. WILLIAMS expressed his great appreciation of the vote, which, he said, would be equally, especially at the present time, appreciated abroad. They had made changes at four of their stations; and each Manager would try, though he would have a difficulty, to do better than his predecessor. They would, he knew, all do their best; and the changes would, if anything, he was quite certain redound to the benefit of the Company.

Mr. H. D. ELLIS remarked that a vote of thanks, which was most excellently deserved, had been passed to their "lower house," represented by their Managers and their staffs; and it was his pleasure to propose, and he knew this would meet with the approbation of the shareholders generally, a vote of thanks to their "upper house," represented by their Chairman and his colleagues. In another place, the Upper House now and then came in for some hard knocks; but here there was nothing but praise and congratulation for the "upper house." Their Company was one of the best managed with which he was acquainted.

Mr. COPPEN seconded the motion; and it was at once unanimously carried.

The CHAIRMAN, in acknowledging the vote, said he could assure the shareholders that in this Company it was not such an arduous duty to conduct the business as it was in some cases where there were crooked ways abroad, and where matters did not go so smoothly as with their own Company. At the same time, the Directors had their anxieties, involving thought and care; and it was indeed a great pleasure to find not only that their officers agreed with them, and accepted what the Directors dictated and advised, but that what was done was appreciated by the shareholders.

This concluded the proceedings.

ANNFIELD PLAIN GAS SCHEME.

At the last Monthly Meeting of the Annfield Plain Urban District Council, a report was presented by the deputation that attended the proceedings on the Annfield Plain and District Gas Bill in both Houses of Parliament.

The report stated that, as originally drafted, the Bill was open to very great objection on many points; but before any expenditure was incurred in opposing, a meeting was arranged with the promoters, who are the present owners of the gas-works at Kyo and Dipton. The chief points to which objection was taken were: (1) The large amount of capital proposed to be raised; (2) the inclusion of the areas of Tanfield and Medomsley; (3) the standard rate of dividend, 10 per cent.; (4) the standard price of gas, which was 4s. 3d. per 1000 cubic feet, with a sliding-scale; (5) the arrangements under which the promoters were to sell the gas undertaking to the Company to be incorporated under the Bill. When the Bill left the House of Commons Committee, several alterations had been made. The parish of Medomsley, which was already included in the area of the Shotley Bridge Gas Company, was struck out; the standard price of gas was reduced from 4s. 3d. to 4s. per 1000 cubic feet; and the capital was lowered to £48,000, as against £60,000 originally proposed. The Council decided to carry their opposition to the Lords; the main ground of their petition being that the Bill, as it left the Commons, would enable the promoters to claim a large sum for goodwill and prospective value. Their Lordships upheld the contention of the Council on this point, and decided that the price to be paid the promoters by the new Company should be the actual price paid by the promoters, *plus* the value of any work executed since the purchasing of the undertaking by the promoters; the value of the added works to be ascertained by an independent arbitrator. The opposition to the Bill had therefore resulted in the following advantages: (1) The reduction of the standard price of gas by 3d. per 1000 cubic feet; (2) the reduction of the standard rate of dividend by 3 per cent.; (3) the arrangement for the sale of the gas undertaking to the new Company, by which the Company is saved from all liabilities for sums representing goodwill and prospective value. The arrangements meant a large yearly saving to the gas consumers of the district.

INSPECTION OF FACTORIES AND WORKSHOPS.

Further Extracts from the Report of the Chief Inspector.

At the close of the notice of the last report of the Chief Inspector of Factories and Workshops which appeared in the "JOURNAL" last week, it was mentioned that it included reports by the Lady Inspectors and the Electrical and Medical Inspectors. These contain matters which it may be of interest to reproduce.

Miss Power sent to the Principal Lady Inspector (Miss A. M. Anderson) a summary of the reasons for having free ventilation in workrooms—laying special emphasis on its importance in places where gas is supplied for lighting, heating, or motive power. She supports the contention as to the insidious effect on health of slow contamination of the air by leakages of coal gas with the authority of Professor J. Lorraine Smith and Dr. Corfield, and reminds her Chief that it is a matter of general experience that gas-fittings tend to leak from time to time, and the consequent escape of unburnt gas is familiar in its unpleasantness, though difficult to locate. It may arise from the fittings of stoves, burners, kilting-machines, gas-irons, and the like, or from supply-pipes against walls or below the flooring of rooms in which work is carried on. Such leakage may be due to faulty workmanship, to deterioration of fittings by the action of corrosive substances in the gas itself, or to fracture of fittings owing to pressure, &c. Gas companies are apt to alter the pressure considerably during the 24 hours between sunset and sunset, and intermittently altered pressure, of course, subjects fittings to considerable strain. In this connection, it would appear that it is of importance to have some means of estimating quantitatively the amount of coal or carburetted water gas detectable in the air of factories and workshops by the sense of smell, with a view to facilitating the estimation of the amount of carbon monoxide *per se* present, and its relation to the minimum (0·004 to 0·046 per cent.) capable of inducing symptoms in susceptible individuals. Miss Power says flueless gas-stoves seem to deserve especial consideration, inasmuch as they may conceivably contribute carbon monoxide to the air of workrooms from the incomplete combustion of gaseous fuel when in use, and owing to leakage of unburnt gas from defective fittings when not in use. Miss Anderson points out that an important factor to be borne in mind in this connection is the frequent insensibility to the presence of the poison on the part of the human beings exposed to it. She cites an instance in which she entered a workroom where she became immediately aware of a serious escape of gas, which neither the workers nor the forewomen appeared to notice. Application of a match to the fittings of the iron-heater instantly produced a flame. She adds that the close connection between the ventilation, lighting, and heating of workrooms was again and again pressed on her notice last year, and not least in the case of a small workshop, where the occupier was engaged in quiet, steady, and ingenious efforts to evade both the Public Health Act requirements as to ventilation and those of the Factory Act as to the temperature of his workrooms.

On the subject of warming, one of the lady inspectors reports that the means employed in factories she visited in provincial towns during the past year were generally far better than those existing in similar works in London. An installation of hot pipes is the rule rather than the exception; and she found scarcely any unwarmed rooms or rooms warmed by unventilated gas-jets or gas-stoves, as is still too often the case in London. As regards artificial means of lighting, another lady inspector says the continuous use, especially on foggy or dark days, of electric light, has had, she feels sure, very injurious effects on the eyes of the workers, especially where there is a tendency to weakness. She considers that this means of lighting is most beneficial as compared with gas in securing greater purity of air; but over and over again she has noticed the strained look in the eyes of workers who have to use it for many hours at a time, or in rooms where the lights are not sufficiently screened. Occupiers have, however, given every help on this point, and have, in most cases, taken immediate steps to have the lights sufficiently low and screened with green or some other "cool" colour. The number of workers obliged to wear glasses may also depend on the fact that electric light is in constant use in schools; a large proportion of the workers questioned having stated that they suffered from weak sight before leaving school.

The Medical Inspector (Dr. T. M. Legge), referring to poisoning by carbon monoxide, summarizes the reports made by certifying surgeons during the past year. He says 55 persons are referred to as having suffered, with fatal issue in four. There were 20 cases resulting from the inhalation of producer, Mond, or suction gas, 16 from coal gas (in several instances containing carburetted water gas), 17 from blast-furnace gas, and one each from charcoal fumes from a brazier and from the cleaning out of an oil-gas holder. The causes in the cases due to power gas were: (1) Improper situation of the gas plant in the cellar or basement, allowing gas to collect or pass upward; (2) defective fittings; (3) starting the suction-gas plant by the fan, with the chimney-valve closed; (4) cleaning out scrubbers or repairing valves, &c.; (5) defective gasholder. In the 16 cases due to coal gas, the causes were: (1) Gas-jets left on in a weaving-shed all night, the gas containing carburetted water gas, and four workers being affected; (2) defective gas-fittings; (3) escape from underground flues; (4) confined situation of gas-engine; (5) incomplete combustion from a coal-gas fire used for heating water in a small shed of only 200 cubic feet capacity. In the 17 cases due to blast-furnace gas, six were owing to the conveyance of the gas by the wind from a flue left open for cleaning purposes into an engineering shed, two to charging the cupola furnace, two to entering the furnace, and four to cleaning the flues. In addition to the foregoing, mention is made of other slight cases of poisoning; but they did not result in any incapacity for work. Mr. Law (Halifax) and Dr. Legge obtained an order prohibiting the use of an old Dowson gas plant because of the leaky condition of the gasholder and the occurrence of poisoning, not only to the attendant, but also to women employed in a factory some distance away, but into which the gas had made its way owing to the situation of the plant at the foot of a cliff. It is stated that the iron plates on the top of the holder were worn so thin that with a slight pressure (1½ inches) of

the gas inside they were moving up and down like thin ice when a skater passes over it. There was evidence on these plates of much recent patching of clay—one patch being about 2½ in. by 1½ in. Despite this, the gas had forced its way through, and was coming out in a stream so strong as to cool the hand when placed over it. Escapes of gas could be seen issuing from at least six other defective points. The staging where the coke-furnace of the plant was fed was immediately above this gasholder. Consequently, the fumes would tend to rise and affect the person employed at this point. Dr. Legge points out that the memorandum as to the use of water gas and other gases in factories was further revised during the year. This was given in its amended form in the "JOURNAL" for June 5, 1906 (p. 656).

The report of the Electrical Inspector (Mr. G. Scott Ram) contains tabulated statements in regard to the accidents reported during the past year, accompanied by full particulars in regard to their nature. The table of accidents at the stations of electricity supply companies or local authorities contains the following figures: Caused by non-electrical plant, 200 non-fatal, 8 fatal; electrical plant, 37 non-fatal, 2 fatal. At private electrical generating stations, the non-electrical accidents were 42, of which one was fatal; the electrical accidents being 14, all non-fatal. There were 191 accidents reported in connection with electrical appliances in factories, engineering works, &c.; and eight of them were fatal.

SOUTH METROPOLITAN GAS COMPANY.

Eighteenth Annual Bonus Distribution.

In this month's issue of the Company's "Co-Partnership Journal," Sir George Livesey writes: Eighteen successful years of the Co-Partnership Scheme of the South Metropolitan Gas Company have passed, and the eighteenth bonus is now declared at the rate of 9¾ per cent. on salaries and wages, amounting to about £45,000.

Co-partnership has experienced prosperity and adversity in the eighteen years. The first bonus was at the rate of 5 per cent. in 1890. Then coal became dearer; and the price of gas went up in 1892, and the bonus went down to 3 per cent. It then gradually rose to 9 per cent. in 1900, and, coal again rising in price, gas had to follow, and in 1901 the bonus fell to 3¾ per cent., to rise again gradually to 9¾ per cent. in 1905. We were often told that "so long as the bonus is rising, the workmen will be content; but wait until it falls, and see what will happen." The reply always has been that workmen were quite as reasonable as other people, if matters were explained to them, and with a reduced bonus they would still be content. And so it has happened twice, and will happen again next year. The great advance in the cost of coal makes an increase in the price of gas absolutely necessary. The increase will be to 2s. 3d. per 1000 cubic feet. A reduction of dividend will follow, and also a reduction of bonus, which next year will be reduced to 7½ per cent. Ours is a partnership—a co-partnership, in fact a triple partnership of customers, workers, and shareholders. If it is a true partnership, adversity will not harm it, for adversity brings out noble qualities whose existence cannot be manifested under continuous prosperity. All we have to ask ourselves is whether ours is a true partnership based on right principles. If so, and seeing that all true partnerships are for better, for worse, we must take the rough with the smooth as men. If a real partnership or brotherhood spirit entered into the common affairs of life, the ordinary relations of man with his fellows, whether of business or what not, methinks there would be a strange and much-to-be-desired difference in the world in which we live. I think we are progressing in that direction. There are many and constant indications of a brotherly spirit among us which somehow seems to have grown out of our co-partnership. At any rate, it has developed a comradeship among the employees of all ranks that is very pleasant to see.

I must again remind co-partners that to withdraw and spend the bonus defeats the object we have in view—namely, to help workmen to become owners of property. If this is not done, if, in fact, our system does not improve the condition of co-partners in the present and brighten their prospects for the future, it is useless, and the labour spent upon it is in vain. If, on the other hand, it is the method whereby Capital and Labour can be thoroughly united—the labourer becoming a capitalist, and a partner sharing profit and loss and responsibility—it is worth any amount of effort to make co-partnership an increasing and continuous success. The Directors have done their part. The lasting success of the system depends on the co-partners generally.

I said in 1889, and have often repeated the statement, that we have two objects in view—namely, to give the employees an interest beyond their salaries and wages in working for the Company, and, of quite equal importance, to help them to permanently improve their position in life. Experience now leads me to put the last-named object first, as being sufficient. A body of shareholding employees, thoughtful, thrifty, with a sense of responsibility, animated with a desire to do to others as they would others should do to them, such as co-partnership develops, will do their duty to the Company and take a real interest in the business by which they live.

It is with extreme regret that the Directors have raised the price of gas. Consumers, shareholders, and employees are, however, partners in misfortune which they could not avoid, and all may be assured that the price will be reduced as soon as possible.

Gas and Electricity Supply in Denver (Col.).—The people of Denver (Col.) evidently have confidence in the stability of the local Gas and Electricity Company, for of the $220,000 in dividends of which the distribution was commenced on the 2nd inst., more than $100,000 will be placed to the credit of residents in Denver. It appears that the greater portion of the stock was formerly held by Columbus people; but with the improvement in the Company's position which has coincided with business activity in the city, it has gradually changed hands. It now stands at 82, with a 6 per cent. dividend; and it is expected soon to reach par.

ACCRINGTON GAS AND WATER BOARD.

The Export Coal-Tax.

In the course of his report for the year to March 31 last, Mr. C. Harrison, the General Manager of the Accrington District Gas and Water Board, makes the following remarks.

From October, 1905, the price of gas was reduced 2d. per 1000 cubic feet to all users. This, therefore, is the first full year's experience at the present rates. The coal carbonized during the year was 40,342 tons—an increase of 2672 tons. The make of gas was 429,347,000 cubic feet, showing an increase of 20,443,000 feet. The make per ton was 10,642 cubic feet, or 213 cubic feet less than last year, which is accounted for by the Board being compelled to purchase coal wherever it could be procured; the large foreign demand having interfered, not only with the gas industry, but the country generally. The removal of the 1s. tax is to a large extent the cause of the increased shipments to foreign parts, and of great injury to the gas industry. The advance of 2s 6d. per ton means an additional charge on the gas-works of this country of about £1,875,000 for the current year, and to your Board alone of some £6000.

There have been added 384 new consumers during the year, 25 additional street-lamps, and 610 cookers and gas-fires. There are now 5744 cookers and fires in the Board's district. The number of prepayment meters is 5355, and the average consumption per meter is 10,238 cubic feet—an increased average of 670 cubic feet per meter. The gross profits for the year are £21,822; and after payment of the annuities, interest on debenture stock and mortgage bonds, contributions to sinking fund, income-tax, and capital charges paid out of revenue, there remains a balance of £3319 to meet the deficiency on the water undertaking of £2953.

The revenue from water amounts to £22,741, an increase of £611 for the year. The deficiency in this department amounts to £2953, being £520 less than last year. The water filtered and pumped into the district from the Dean reservoir amounted to 305,625,000 gallons, and the quantity filtered but not pumped to 2,330,000 gallons; making a total of 307,995,000 gallons taken from the Dean reservoir during the year. There have been added 228 new consumers during the year. The total length of water-mains is 71 miles.

GAS AND WATER AT MANSFIELD.

The gross profit on the past year's working of the Mansfield gas undertaking is £7727. After allowing for interest on loans (including Treasurer's interest) £3492, and contributions to sinking fund £1234, a net profit remains of £3001. The receipts from the sale of gas were £100 less than in the previous year. This is accounted for by the reduction in the price. Residuals realized about £250 more. The expenditure on the manufacture of gas was £1100 less than in the previous year, owing to the fact that there was in the former year exceptional expenditure in the retort-house. The price of gas was reduced to 2s. 4d., 2s. 6d., and 2s. 8d. per 1000 cubic feet, according to consumption, from Dec. 31 last. It has also been decided that from March 31 the price of gas for engines only should be reduced to 1s. 6d., 1s. 9d., 2s., and 2s. 2d. per 1000 cubic feet, according to consumption. The Committee have decided that the sum of £2000 shall be paid over to the general district rate, and that the balance of profit (£1001) shall be appropriated to the reserve fund.

The report dealing with the water undertaking shows that the total income for the year (four quarters) amounted to £9517, compared with £10,559 for the previous year (five quarters). The total expenditure, apart from dividends, interest, and sinking fund (twelve months) was £2325, as against £2498 in the previous year (thirteen months). The gross profit amounts to £7212. After payment of interest on loans £2114, and contributions to sinking fund £1589, a net profit of £3509 has been made. The Committee have decided to pay over the sum of £3000 to the general district rate, and to appropriate the balance of £507 to the reserve fund.

GAS AND WATER ADMINISTRATION AT BARRY.

Further Consideration of Mr. Porter's Report.

The Barry Gas and Water Committee have lately been considering the report by Mr. Robert Porter, of Elland, who had been asked to inquire into the management and general administration of the gas and water undertakings. Portions of the report on the gas-works were given in the "JOURNAL" for the 9th inst. (p. 117); and it was stated that, after this had been discussed, the matter was adjourned for a fortnight, so as to enable Mr. F. M. Harris, the Engineer and Manager, to prepare a statement. The Committee met again yesterday week, when Mr. Harris's statement and Mr. Porter's report on the water-works were considered.

Mr. Harris commenced by remarking that he assumed there was no need to make comments or statements of fact, among which were included the site of the works, the unaccounted-for gas, and the capital employed, which was largely influenced by, if not mainly due to, the amount paid for the undertaking. He then proceeded to consider points that Mr. Porter had criticized. He said that at the time Mr. Porter paid his visit, they were on the point of painting certain portions of the plant—the condensers, washers, scrubbers, &c.—not, however, at the suggestion of Mr. Porter, but in the ordinary course of work. Situated as the gas-works were so close to the coal-tips of the docks, the dust arising and intermingling with that made in the ordinary course of gas manufacture, soon altered the appearance of paint work, and neutralized any good effect. At the previous meeting, comment was made upon the fact that he (Mr. Harris) had complained that the works were undermanned, and

that, at the request of the Committee, he had had to dispense with the labour required. The question of the number of men employed had been raised during the consideration of each estimate; and this statement was confirmed in a minute of the Council, which stated that the Committee considered one jointer in a gang sufficient, and accordingly the last jointer engaged must be dispensed with, but be offered a job as labourer, and, if the position was accepted, that a labourer be discharged. A further minute recommended that the Gas Engineer should dispense with the services of the last gas-fitter engaged, and also with the services of any boys who accompanied fitters who were not required. With the exception of one bed, the horizontal retorts were practically burnt out, and required renewing. With a good deal of patching and repairing, some work could no doubt be obtained from the five through beds of horizontal retorts; but Mr. Harris did not believe Mr. Porter intended to convey the impression that the horizontal retorts would yield 480,000 cubic feet in the 24 hours under existing conditions. Mr. Harris regretted that on the working of the inclined system, he could not make his figures agree with those of Mr. Porter. In making the statement that a sufficient sum had not been spent each year to maintain the undertaking in an efficient manner, Mr. Porter was doubtless unaware that nothing had been expended for the repair and renewal of retorts for the past three or four years, which sum (about £500 a year) would go a long way towards bringing the amount up to that suggested by Mr. Porter. The statement that the method of driving elevators and conveyors from gas-engines was far more expensive than steam, was an open question. The engines were worked intermittently; and the Council received a good price for breeze. Mr. Harris agreed that additions to the exhausters would soon be necessary, and the station-meter ought to be replaced with a new one of larger capacity, as the maximum capacity had often been exceeded, and the risk of failure, more especially with exhausters, was serious to contemplate. At the time Mr. Porter called, one workshop only was in use for the Gas Department; and this was employed principally for cleaning cooking-stoves. No exception was taken to any of the plant when inspected by the expert engineer consulted by the Local Board when the works were acquired in 1894; and the fact that the plant was now producing quite four times the quantity it was in that year, was a good test of its efficiency. Mr. Porter made no recommendation on the question of coal, or as to any particular class of coal to give the best results; and to Mr. Harris's knowledge he had not had any experience of local coal. To make no reference at all to the matter, was the only course Mr. Porter could adopt.

Mr. Porter's report on the water-works was then taken. In it, he said that in 1895 the capital employed was £132,551; the amount of water provided, 151,710,000 gallons; and the net rentals amounted to about £5000. At the end of 1905, the capital employed was £176,143; the quantity of water provided, 253,804,000 gallons; and the net rentals amounted to £8228. The increase in the daily consumption during the ten years was 361,927 gallons. The total water-mains laid represented 65 miles; and the population supplied with water, 32,000. There had been a decided reduction of capital per million gallons employed; but, owing to the wide area supplied, and the sparsity of the population, this must remain a burden on the undertaking for many years. The total cost of pumping, wages and salaries, maintenance, rates and incidentals, amounted to £4443. Much depended upon the efficiency of the pumping-station at Biglis, because it was the source from which the water was obtained; and 50 per cent. of the expenditure was incurred there. Generally, Mr. Porter was of opinion that whatever good work may have been accomplished during the past by the plant, the whole of it was now absolutely obsolete, and incapable of performing the functions required with anything approaching efficiency. Owing to their small capacity, the existing boilers had been the cause of extravagance for some years. The storage of the high and low level supplies increased the gravity of the situation regarding the pumping-station. The low-level reservoir was much below the amount required for efficiency and economy; and as this supplied five-sixths of the population, and had much less than two days' supply, it was needless to enlarge on the importance of prompt action by the Committee and management, so as to prevent a calamity which might seriously menace the well-being of the district. Mutual confidence ought to be exercised by the Committee and Engineer, and he was of opinion that the administration of the undertaking would with advantage be better accomplished by a Committee acting altogether separate from the Gas Committee. Having regard to the future requirements of the Gas and Water Department, and the various and complex questions which must arise during the reconstruction and development of the concerns, there would be sufficient employment for a separate Engineer and Committee for each of the undertakings.

Mr. E. W. Waite, the Water Engineer, had prepared a reply to this, in which he agreed that, owing to the wide area and sparsity of the population, the capital must remain a burden upon the undertaking for many years. Regarding the ratio of population to mileage of mains, Barry was undoubtedly considerably lower than the great majority of towns. He had called the attention of the Committee to the serious necessity of adding to the pumping plant and boiler power; the former consisting of one pair of vertical triple expansion pumps, and two horizontal pumps. The vertical pumps were undoubtedly becoming obsolete, but were useful as a stand-by. However, the two horizontals, upon which they had to depend, were in excellent condition. Inasmuch as machinery of the highest workmanship was liable to accident, he strongly advised the acquirement of a new pump capable of lifting 50,000 to 60,000 gallons per hour. The boilers were in good condition; but he urged the use of coal to a larger extent. As a result of the many hundreds of empty houses becoming occupied, the need of extra storage accommodation was again becoming apparent. A covered reservoir, with a capacity of 3 million gallons, should be constructed as early as possible. This, with the existing accommodation, would ensure a supply for seven days. An excellent site for a reservoir was to be found in a field to the west of the existing reservoir, with the additional advantage of an elevation which would provide an adequate pressure of water in certain portions of the district on the low-level system. A considerable amount of water was wasted on account of defective fittings and carelessness; and this could only be obviated by regular inspection, especially at night. With over 60 miles of mains, and a steadily increasing population, he did not think the present inspection staff of three men adequate. An additional inspector, chiefly for night work, would be of great service. Speaking generally, he did not agree with Mr. Porter that the whole of the pumping plant was obsolete; the larger portion being capable of doing good work for some time to come. With his remarks as to the necessity of keeping the plant well in advance of immediate requirements in so important a matter as water supply, Mr. Waite entirely agreed; and he hoped the Committee would, in the general interests, and for the adequate protection of the town, agree to the proposals he had made.

The meeting was, after some discussion, adjourned until Thursday, when Mr. Davies moved that the Council be recommended to place the two departments under one Manager. This was carried by five votes to two; and upon this further resolutions were carried in a like manner, to determine the services of the Gas and Water Engineers respectively. It was agreed to recommend the Council to advertise for a Manager for the Gas and Water Departments combined, at a salary of £400 a year. All these resolutions will come forward for discussion in the form of recommendations to be dealt with by the Council at a special meeting to be held to-day. During the proceedings, some reference was made to coal tests; it being remarked that the Committee had not been supplied with comparative tests for certain classes of coal. It was thereupon suggested by Mr. Williams that all resolutions should be made known to Mr. Harris; and he asked whether that official had declined to provide the information desired by the Committee, and whether, if he had not given it, it was due to causes of over-work. After discussion, the resolution moved by Mr. Davies was communicated to Mr. Harris, who stated that the men were at present working at their full capacity; and it would be dangerous for them to attend to coal tests as well as provide gas for the town.

SULPHATE OF AMMONIA COMMITTEE.

Extracts from Annual Report—Effect of Sulphate of Ammonia on the Yield of Crops.

At the recent meeting of the subscribers to the Sulphate of Ammonia Committee, the Executive Committee submitted their tenth annual report, together with a statement of accounts for the year ending June 30. The following are extracts from the report, which was submitted and adopted.

The number of competitions organized for the Committee's prizes during the period under notice was 72; but, as in previous years, several were abandoned for lack of sufficient entries and other causes, and only 66 were actually concluded. The considerable diminution in the total number of competitions, compared with previous years, is due to the fact that the Committee have again confined their offer of prizes to the more important Societies, and have endeavoured to prevent the overlapping of districts which occurred in former years. During the current year, special efforts have been directed to getting Agricultural Societies, which have not hitherto taken up the Committee's offer of prizes, to do so this year; and out of 78 competitions arranged, 25 were undertaken by Societies which have not hitherto competed. Last season's competitions are briefly dealt with in the preliminary report of the Committee's Technical Adviser; and the results are regarded as satisfactory in spite of the generally unfavourable season for potato and root crops.

As in previous years, the Committee's advertisements appeared in the chief agricultural and horticultural papers and periodicals during the continuance of the manuring season.

The Committee's representative, who was appointed last year, has, during the past twelve months, visited the chief agricultural centres in England, where he has interviewed the Secretaries of Agricultural Societies and called on agricultural and horticultural dealers and manure merchants with a view to securing their co-operation in increasing the sales of sulphate of ammonia. To aid them in this, the dealers have been supplied with large quantities of the Committee's literature, with their names and addresses printed on the covers, for circulation among their customers.

The Committee's show-stand was exhibited at the following Agricultural Shows, where samples of sulphate of ammonia and specimens of agricultural produce grown with its aid were shown; and your representative distributed large quantities of literature and supplied general information: The Peterborough Agricultural Society's Show at Peterborough, July 10 to 12, 1906; the Northumberland Agricultural Society's Show at Newcastle-on-Tyne, July 25 to 27, 1906; the Royal Lancashire Agricultural Society's Show at Lancaster, Aug. 2 to 6, 1906; the Devon County Agricultural Society's Show at Bideford, May 22 and 23, 1907; the Essex County Agricultural Society's Show at Chelmsford, June 12 and 13, 1907; the Herefordshire and Worcestershire Agricultural Society's Show at Hereford, June 18 to 20, 1907; the Royal Agricultural Society's Show at Lincoln, June 25 to 29, 1907; the Highland Agricultural Society's Show at Edinburgh, July 9 to 12, 1907. The Committee will also exhibit at the Yorkshire Agricultural Society's Show at Barnsley, Aug. 8 to 12 of the present year.

The Committee are exhibiting at the Irish International Exhibition in Dublin, where, in addition to their stand, they have a number of very interesting experimental plots, which are attracting considerable attention. On these plots are being grown various kinds of potatoes, mangels, swedes, turnips, grain, grasses, &c., manured with sulphate of ammonia in combination with potash salts and superphosphate; and on adjoining plots, for the purpose of comparison, are similar crops manured as above, but with sulphate of ammonia omitted from the mixture.

During the year, the Committee have (as an advertisement) disposed of about 55 gross of their decorated tin canisters to subscribers and dealers, and the window lettering has been placed on the premises of upwards of 200 agricultural and horticultural dealers, &c., in different parts of the United Kingdom.

The new subscribers secured during the year number 28, with an

estimated annual production of 7000 to 8000 tons of sulphate of ammonia. The subscriptions for the year show a total increase compared with the preceding year of equal to about 16,000 tons.

From the report of the Committee's Technical Adviser, the following tables are taken, showing the large additional yields in crops per acre obtained in the competitions by the application of sulphate of ammonia.

Class I.—Yellow Turnips.

11 Competitions, embracing a total of 128 entries—all Scottish.
1—Morayshire Farmers' Club.

	Crop per Acre. Tons.	Cwt.	Qrs.	Lbs.
With sulphate of ammonia. . . .	56	11	1	20
Without ,, ,, ...	42	0	0	0
Increase	14	11	1	20

Class II.—Swedes.

23 English Competitions, embracing 173 entries.
1—Cartmel Agricultural Society.

	Tons.	Cwt.	Qrs.	Lbs.
With sulphate of ammonia. . . .	44	10	0	3
Without ,, ,, ...	31	0	0	0
Increase	13	10	0	3

11 Scottish Competitions, embracing 140 entries.
1.—Morayshire Farmers' Club.

	Tons.	Cwt.	Qrs.	Lbs.
With sulphate of ammonia. . . .	48	5	1	24
Without ,, ,, ...	40	1	1	20
Increase	8	4	0	4

Class III.—Mangels.

18 Competitions, embracing 112 entries (all English).
1.—Mid-Somerset Agricultural Society.

	Tons.	Cwt.	Qrs.	Lbs.
With sulphate of ammonia. . . .	78	11	1	20
Without ,, ,, ...	65	0	0	0
Increase	13	11	1	20

Class IV.—Early Potatoes.

No competitions.

Class V.—Late Potatoes.

3 Competitions, embracing 18 entries (all English).
1.—Middlesex Agricultural and Market Garden Society.

	Tons.	Cwt.	Qrs.	Lbs.
All grown with sulphate of ammonia.	14	6	0	0

METROPOLITAN WATER BOARD.

The Board's Capital Expenditure—The Value of Storage.

At the Meeting of the Board on Friday—Sir Melvill Beachcroft in the chair—the Finance Committee reported that, according to a statement received by them from the Comptroller (Mr. F. E. Harris), the total expenditure on capital account from the "appointed days" on which the Board took over the water undertakings to March 31 last amounted to £2,684,387, of which £2,143,844 had been raised by the issue of stock—leaving a deficiency of £540,543 on the aggregate account. The deficiency had been met to the extent of £491,733 by the issue of £500,000 Metropolitan Water Board bills; and the difference was provided out of the Board's current balances. It was decided to apply to the Local Government Board for consent to the raising of a number of loans, including one of £68,330 in respect of the general extension of service mains, and £54,539 in respect of special mains.

On the recommendation of the Finance Committee, it was agreed that the Board should not take out a policy of insurance against risks under the Workmen's Compensation Act, 1906, for the ensuing year, but that they should set aside for such year a sum equal to a rate of 9s. per cent. upon the salaries and wages paid within this period to officers and workmen coming within the scope of the Act, and that a full record be kept of cases arising under the Act during the year.

On the subject of the Board's Charges Bill, Mr. Emden complained that further opportunity had not been afforded for the discussion of the proposals contained in the Bill; and he moved the adjournment of the Board in order to call attention to the matter. He said it had been reported that a considerable amount of relief was to be given to large traders, by reducing the rates to them to something like cost price; while the smaller traders were to be charged the full price, and the balance of the expense was to be thrown on those who were already excessively rated, and on the general class, by whom the bulk of the rates were paid. Mr. J. M. Stone (the Vice-Chairman of the Law and Parliamentary Committee) said the Committee had been pressed by the Local Government Board to amend the trade scale as printed in the Bill. They had not seen their way to do this; but, in view of the strong feeling shown in regard to the matter, it was thought likely that an amendment might be supported by the Local Government Board. The Committee had had an opportunity of conferring with the President; and it was thought that if any amendment should be insisted upon its effect would be to reduce by something like £24,000 a year the increased yearly revenue of £52,000 which the Bill proposed to obtain from trade consumers. The motion was lost by a large majority.

The Water Examination Committee presented an exhaustive report, which had been prepared by the Director of Water Examinations (Dr. A. C. Houston) respecting the work carried out at the Board's laboratory during the twelve months ended March 31 last. The report gave in considerable detail the results obtained in the testing of 11,993 samples of London waters, and also dealt at length with the important question of the value of storage. He pointed out that there is a consensus of opinion among bacteriologists that pathogenic microbes do not multiply in storage reservoirs, but gradually lose their vitality. The time required to effect the destruction of these bacteria is matter for controversy; and though the American authorities consider a few days may suffice, most British bacteriologists place the limit at a much longer period. The essential point is that each day's storage makes for safety, and that a time eventually arrives when all the pathogenic bacteria have perished; and in such a case subsequent filtration alone is required to improve the chemical and physical qualities of a water already incapable of giving rise to epidemic disease. From the epidemiological point of view, apart from any question of cost of pumping, the storage reservoirs should be so worked as to give each drop of river water abstracted for water-works purposes the maximum number of days' detention in store. Dr. Houston concluded by submitting the following points as being of importance: The unsatisfactory quality of the raw waters, particularly during the winter months, and the necessity for the judicious selection of such waters for purposes of supply; the doubt existing as to whether these waters, even during the best months of the year, are sufficiently free from impurities to be filtered without antecedent storage; and the importance of possessing as full knowledge as possible of the multiple polutions of the Thames and Lea. On the subject of storage, Dr. Houston directed attention to the unequal, and in some cases inadequate, duration of storage in connection with the Board's works, as well as to the difference between "active" and "passive" storage; and he emphasized the importance of the former. The rate of filtration at the different works of the Board is unequal, and in some cases inadequate, owing to the small size of the service reservoirs. On the subject of filtered water, Dr. Houston mentioned the following points: The variable, and in some cases not altogether satisfactory, quality of the water as delivered to the consumers, and its general deterioration during the winter months; the remarkable percentage improvement in the raw water effected by the process of storage and filtration; the satisfactory quality, generally speaking, of the water supplied to the Metropolis, as judged by average results, more particularly by those obtained during the summer months; and the importance of bringing the worst results more closely into agreement with the best, by endeavouring to reduce the manifold pollutions of the Thames and Lea, by the judicious selection of raw water, by the active utilization of storage reservoirs, and by slow filtration at a uniform rate through sand of sufficient fineness and depth.

An estimate of £30,000 in respect of pumping machinery, houses, &c., at Walton was approved on the recommendation of the Works and Stores Committee. It was also decided, after some discussion as to designs, to erect a water-tower on the Board's land at Shooter's Hill, the estimate for the construction being £5000.

Bahia Blanca Gas Company, Limited.

In another part of the "JOURNAL" will be found the prospectus of this Company, which has been incorporated with a capital of £300,000, in 46,000 ordinary "A" shares of £5 and 70,000 ordinary "B" shares of £1. The prospectus sets forth that the Bahia Blanca Gas-Works (Construction) Syndicate, Limited, which was formed on June 26, 1906, entered into a contract for the acquisition of a permit from the Municipality of Bahia Blanca, in the Argentine Republic, to instal in the precincts of the city a manufactory of illuminating gas, with the capacity to produce as a minimum 3000 cubic metres in 24 hours, and for the acquisition of a suitable plot of land, about 16½ acres in area, situate in the vicinity of Bahia Blanca; and that they have erected thereon gas-works, machinery, and plant approaching completion, with a capacity to produce 60 million cubic feet of gas per annum. The undertaking is reported to be practically in order for the supply of gas within about a month from the present time. The Syndicate are the promoters of the Company, who, according to the prospectus, will acquire "the permit, the land, and all the works as constructed, and other benefits and rights," for £70,000 in fully paid-up ordinary "B" shares and £70,000 in cash or ordinary "A" shares, fully paid-up, at the option of the Company, and £44,530 in cash, the last two amounts being the estimated expenditure of the Syndicate upon a cash basis. The present issue consists of 30,000 ordinary "A" shares at par, leaving 16,000 for future issue. Out of the profits available for distribution in each year, the "A" shares will be first entitled to a non-cumulative dividend of 6 per cent. per annum; then the "B" shares will be entitled to a like dividend; and the surplus profits will be distributed as to one-half among the "A" and the other half among the "B" shares. The three Directors are members of the Board of the Buenos Ayres (New) Gas Company, Limited, and applications from shareholders in that Company will receive prior consideration.

New Joint-Stock Companies.—The Sunlight and Safety Lamp Company, Limited, with a capital of £50,000, in £1 shares, is to acquire from the Sunlight and Safety Lamp Company, Limited, and its Liquidator, the business of the old Company, and to carry on the business of manufacturers and exporters of, and dealers in, oil, gas, electric, and other lamps, lamp accessories, and heating and lighting appliances of all kinds. "Monazite" is the title of a Company registered with a capital of £7500, in £1 shares, to carry on the business of company promoters, financiers, &c. The Aristodas Dustless Roads Syndicate, Limited, with a capital of £2000, in £1 shares, will adopt an agreement with J. W. Metcalf to acquire the patents granted to him for an invention for a new method of tarring roads and apparatus and machinery therefor, together with any subsequent inventions therein. The Anchor Tube Company, Limited, with a capital of £50,000, in £1 shares (10,000 shares being 5 per cent. preference), is to acquire, as from April 1, 1907, the business of tube manufacturers carried on in Gas Street, Birmingham, and elsewhere, as the Anchor Tube Company; to adopt an agreement with T. Turley, J. H. Turley, and C. H. Turley; and to carry on the business of manufacturers of, and dealers in, iron, steel, brass, copper, and other tubes, pipes, fittings, and boilers, metallurgists, engineers, &c.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh and Leith Gas Commissioners have not benefited by delaying to enter upon contracts for coal for the current year. In the end of April they purchased 40,000 tons of cannel, and delayed consideration of the purchase of common coal. At that time, it was reported that the increase in the price of the coal tendered was 3s. 4d. per ton. On Monday last they held a special meeting, at which they purchased 94,000 tons, to supply them till May of next year. There must be a large stock of coal on hand, because the two purchases amount together to 134,000 tons, whereas the quantity of coal carbonized during the past financial year was 178,524 tons. The prices on this occasion were not disclosed; but it is understood that the increase, all over, is about 4s. per ton, as compared with what was paid last year. The increase in price will amount to about £20,000 in the year. A penny per 1000 cubic feet of gas produces £7952; consequently it will be seen that the increase in the cost of coal will not amount to quite 3d. per 1000 feet of gas. The price, I understand, is not likely to be raised by so much as that, but that will not be known at the earliest till September, when the price for the year comes to be fixed.

The "Glasgow Herald"—attentive, as usual, to the interests of the Commissioners, where coal is concerned—on Tuesday published the following comment upon the transaction: "It was mentioned in the 'Herald' in April last that the increase in the price of coal had caused the Edinburgh and Leith Gas Commissioners to postpone placing their coal contracts for the year, in the hope that a more favourable opportunity might present itself for purchase. At that time the total quantity offered was not more than about one-half of what was usually offered in response to the Commissioners' invitation for tenders. There were then various causes at work; but, so far as could be ascertained then, the increase in exports could not account for such an apparent shortage. The prices seemed to have moved upwards in proportion to the diminishing available supplies. Yesterday the Works Committee of the Commissioners considered the report of Mr. W. R. Herring, the Engineer, on the tenders for coal, and considerable discussion ensued in private. It was afterwards intimated by the Chairman—Judge Bryson, Leith—that the Committee had agreed to purchase 94,000 tons of coal to May next. While the price was not disclosed, it is understood that the average price is 13s. 9d. per ton, representing a difference of some 4s. per ton more than the price paid last year, or, taken in the gross, £18,800. This means that the gas-consuming public will be required to pay the difference." This statement is remarkably like what was in circulation at the close of the meeting, and points to the view that the comments which the "Glasgow Herald" consistently publishes whenever the Commissioners are engaged upon considerations relating to the coal market are inspired.

The Commissioners have been unfortunate in again getting into Court over the pollution, this time, of the second well, in Messrs. Muir's brewery. The action is a more drastic one than was the last, inasmuch as the sum sued for as damages is £15,000, as against £10,000. Both sides have profited by the experience of the last case; the pursuers having framed their record more skilfully, and the defenders being able to put forward the powerful plea that the remedial measures they are taking, and the sum they have already paid, must be taken into account. In face of this plea, the case cannot be disposed of with anything like haste, as time must be allowed for the ascertainment of the effect which the operations of the Commissioners may have. As a matter of fact, nothing can be done in the case until October, the Court being now in vacation till then. At their meeting on Monday, the Commissioners instructed the Clerk to pay the expenses incurred in the first action—the expenses of the Messrs. Muir, of course—and resolved in the second action to take the award of the Court.

I have received from Mr. R. S. Carlow, the Secretary of the North British Association of Gas Managers, the notice calling the meeting of the Association—the forty-sixth—to be held in Glasgow on Thursday next. Three papers are to be submitted, which is the same as last year. But there is a good deal of other business, some of which will doubtless be taken up, and will occupy some time in discussing. There is the proposal to alter the name of the Association to "The Scottish Institution of Gas Engineers," which may be expected to drag in the question of affiliation. Then there are the proposal to form a Commercial Section, for the assistance of the members in the disposal of bye-products, and the suggested M'Gilchrist Memorial. These three subjects were left over from last year's meeting. There are, in addition, two other matters of longer standing—the question of the publication of the late Mr. Wm. Young's communications to the Association, and the holding of a naphthalene inquiry. It will be apparent to everyone, therefore, that a full day's work is before the meeting, which probably accounts for the early start that is to be made—ten a.m.

At the annual meeting of the Selkirk Gaslight Company on Wednesday, the Directors reported that the quantity of gas manufactured during the year was 37,012,000 cubic feet—an increase upon the previous year of 1,162,000 cubic feet. The quantity of coal carbonized was 3618 tons 11 cwt.; the yield of gas being 10,228 cubic feet per ton. It was also reported that the works were in excellent order, and no expense, beyond the ordinary renewal of retorts, was anticipated upon them during the current year. The Directors recommended that the price of gas be reduced by 2½d.—making it 2s. 6d. per 1000 cubic feet. It was also stated that they had received from the Town Council an offer of £10,087 10s. for the undertaking of the Company, but the offer appeared to the Directors to be so inadequate that they had declined it without deeming it necessary to submit it to the shareholders. The year's profits amounted to £1361, which was recommended to be disposed of as follows: Dividend at 10 per cent. on original capital, £453; depreciation, £250; and surplus account, £658. The expenditure was £4461, and the income £5823. In the balance-sheet, the works, including additions, are entered at £21,224. The report was adopted unanimously.

The annual meeting of the Montrose Gas Company was held on Wednesday. The Manager (Mr. A. Mackay) reported that the quantity of gas manufactured during the year was 31,141,000 cubic feet—an increase of 1,500,000 cubic feet over the previous twelve months. New meters fixed numbered 422. Of these 141 were for fresh consumers. The number of boiling-rings, grills, cookers, and gas-fires fixed was 262. Leakage was reduced by 2 per cent. The profit, after ample allowance for depreciation, amounted to £1038. A dividend was declared at the same rate as last year—£2 per share. Mr. A. Muirden, the Chairman, stated that, notwithstanding the great increase in the cost of coal, the Directors did not anticipate that it would be necessary to raise the price of gas during the current year. The shareholders visited the gas-works, to inspect the retorts recently erected. These comprise twenty mouthpieces. The method of firing is on the shallow regenerative principle. Mr. Mackay prepared the plans, and superintended the work of the Contractors (Messrs. Robert Dempster and Sons, Limited, of Elland). Bailie Thomson paid a high compliment to the Manager for the way he had carried out the work, and moved that it be an instruction to the Directors to substantially increase Mr. Mackay's salary. The Chairman seconded this; and it was unanimously agreed to.

The Brechin Gaslight Company, Limited, held their annual meeting on Wednesday—Mr. J. Guthrie, J.P., in the chair. The Directors recommended the payment of a dividend at the rate of 7 per cent., free of income-tax. The Chairman said that the dividend was for twelve months this time, whereas a year ago it was for thirteen months. They were thus paying a little more on this occasion. The increased consumption of gas amounted to 1¼ million cubic feet. They did not expect so large an increase. Notwithstanding that all the factories in the town produced their own light, that the public lamps were lighted by electricity, and that a large number of shopkeepers used the same light, the Company were in the position that they were making, and the community were using, more gas than they did in the most prosperous days of the old Company (before registration). The income from the ordinary meters was £2803; and from prepayment meters, £2109. If it were not for the latter they would not be where they were. Of course, the prepayment meters meant a great deal of capital outlay; but this was a part of the business which was not being pushed. They had erected a new gasholder, at a cost of £1500, which gave them an increased holding capacity of 60,000 cubic feet. They had allowed £480 for depreciation, which was £23 more than a year ago. As they all knew, the cost of coal had greatly advanced; but it would be pleasant intelligence that there would be no increase in the price of gas. The report of the Directors was adopted; and they were voted £50 as remuneration for their services.

At the annual meeting of the Saltcoats Gas Company, Limited, on Tuesday, the Directors reported that the balance at credit of the profit and loss account, after providing for depreciation of works, amounted to £1579. They recommended the payment of a dividend of 7½ per cent., absorbing £1200, and the carrying forward of £379. The consumption and the revenue from gas are still increasing. It was agreed to continue the price of gas at 3s. 4d. per 1000 cubic feet, and at 2s. 11d. for the public lamps. The premises and plant are in good order. The quantity of coal carbonized was 2578 tons, costing £1545, with £56 for cartage. The gas made amounted to 26,849,500 cubic feet, equal to 10,453 cubic feet per ton. The gas unaccounted for amounted to 5 per cent. The number of ordinary consumers was 2324; and of prepayment meters, 117—the former being an increase of twenty, and the latter of eleven. The number of grillers, &c., on hire is 89. The revenue from gas was £4177; hire of grillers, £4 9s.; meter-rents, £48; tar and liquor, £298; and coke, £340.

Hoylake and West Kirby Gas and Water Company.

The report of the Directors and the accounts for the year ending June 30 (which will be submitted at the thirtieth ordinary general meeting next week) state that the balance at the credit of profit and loss, after payment of the dividends in respect of the year to June, 1906, was £468, to which has to be added the net revenue for the past twelve months, £6838—making a total of £7306. Deducting the interim dividend paid in January (£2320), there is now available a sum of £4986. From this, the Board recommended the payment of the following dividends: 6 per cent. on the "A" gas original capital; 4½ per cent. on the "B" gas additional capital; 6 per cent. on the "A" water original capital; and 4½ per cent. on the "B" water additional capital. These will absorb £3479, and leave a balance of £1507. After transferring £100 to water back-dividend reserve, and £100 to water contingency fund, there will be a sum of £1307 to carry forward. The dividend scheme now announced, together with the interim dividend paid in January, makes a total distribution, less income-tax, for the year of 10 and 7 per cent. on the "A" and "B" capitals respectively. The gas reserve fund now stands at £1565. The Directors regret to state that the price of coal for the ensuing year has considerably advanced. The quantity of gas supplied last year to private consumers and the public lamps was 52,184,054 cubic feet. The price of gas during the period under review was 3s. 6d. per 1000 cubic feet, less varying discounts; while the charge to users of prepayment meters was 4s. 2d.

Opening of a New Pumping-Station at Bedford.—The Mayor of Bedford (Mr. George Haynes), on the invitation of Mr. Joseph Miller, the Chairman of the Water Committee, lately opened a new pumping-station, containing machinery capable of raising a million gallons per 24 hours when running at ordinary speed. The distance from the floor of the house to the top of the rock is 43 ft. 6 in.; while the rock itself has been excavated 17 ft. 6 in.—making the total depth 61 feet. At this depth it was found impossible (with a sinking pump throwing 1¼ million gallons a day) to keep the water down. The total cost of the scheme has been £6248. The Mayor remarked that he never knew a building and machinery to be put up cheaper or better. The work was carried out under the instructions, and to the plans, of the Borough Engineer (Mr. N. Greenshields). The Contractor for the buildings and foundations was Mr. Samuel Foster; while Messrs. Simpson and Co. supplied the machinery, and Mr. John Thompson the boilers.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia.

LIVERPOOL, *July* 20.

Quietness still prevails, there being no special demand for any point, and prices have barely been maintained, although available supplies are not large. The closing quotations, however, remain £11 15s. per ton f.o.b. Hull, £11 17s. 6d. per ton. f.o.b. Liverpool, and £12 per ton f.o.b. Leith. There has been more direct inquiry in the forward position; but the ideas of buyers are not above spot values, while makers require a premium of 2s. 6d. to 5s. per ton, according to position. Consequently, any business done has been taken speculatively.

Nitrate of Soda.

This article is quiet but steady at 11s. to 11s. 3d. per cwt., according to quality.

Tar Products.

LONDON, *July* 20.

There is very little business doing in tar products, and it is unlikely that there will be any great revival of business at present. Pitch remains in about the same position. Business is impossible for prompt delivery, as shipping is now done for the season; while for forward, the ideas of manufacturers are so much over those of dealers (they being unable to obtain any such prices from the Continent) that the latter have no opportunity of buying at present. Continental orders are scarce just now, though doubtless there will be some amount of buying towards the end of the month of August. Creosote is very firm in all directions. Manufacturers do not seem at all anxious to sell any great quantity for forward delivery. It is reported that there are still large orders to come from America, which will have to be placed in this country. Carbolic acid remains in about the same position. Continental consumers refuse to increase their limits; and as manufacturers are well sold, they are not inclined to consider the prices now offered. There is no alteration in crystals. Benzol, 90 per cent., is still quiet, and very low prices are offered for delivery all over next year. Benzol, 50-90's, and toluol are quite without interest, as consumers of these articles are very fully stocked and do not care to increase their liabilities at present. Solvent naphtha appears to be easy in the North, where business is reported to have been done at under 1s., while this price is quoted for delivery all over next year. In London, it is still firm, as actual London makes are in good demand, and manufacturers are pretty well sold. In tar, a contract of some importance is reported to have been let, for delivery over the next three years, at a figure considerably under the minimum price now quoted in this column.

The average values during the week were: Tar, 16s. to 20s. Pitch, London, 26s. nominal; east coast, 25s. to 25s. 6d.; west coast, 23s. 9d. to 24s. 6d. Benzol, 90 per cent., 7¼d. to 8½d.; 50-90 per cent., 8⅜d. to 9¼d. Toluol, 10½d. to 11½d. Crude naphtha, 4d. to 4⅜d.; solvent naphtha, 1s. to 1s. 2¼d.; heavy naphtha, 1s. 1½d. to 1s. 3½d. Creosote, London, 2⅞d. to 3d.; North, 2½d. to 2⅝d. Heavy oils, 3d. to 3⅛d. Carbolic acid, 60 per cent., 1s. 7½d. to 1s. 7⅞d. Naphthalene, £6 to £12; salts, 37s. 6d. to 42s. 6d. Anthracene, "A" quality, 1⅛d. to 1⅜d.

Sulphate of Ammonia.

There is practically no alteration in prices. The principal London Gas Companies still ask £12 2s. 6d. to £12 5s., but no business is reported at this figure; dealers not being inclined to pay this price. Ordinary London makes can be procured on f.o.b. terms at about £11 15s.; and on Beckton terms at £11 13s. 9d. In Leith, the market price remains at about £12. Makers hold out for £12 2s. 6d. to £12 5s., but without success. In Liverpool, the value may be taken at about £11 16s. 3d. to £11 17s. 6d. for prompt. In Hull, some quantity has been sold for forward delivery at £11 16s. 3d., for a fairly good make; and the market still remains at about £11 13s. 9d. for prompt delivery,

COAL TRADE REPORTS.

Lancashire Coal Trade.

Lancashire coal owners remain indifferent to the cries of railway companies and other great consumers who clamour for a reduction in the present charges for coal. There does not, however, appear any likelihood of a change in that direction at present. What is true of Rochdale is no doubt the experience of many similar governing bodies. The Rochdale Corporation have to pay 2s. 7d. per ton more than last year for the 55,000 tons of coal required for their Gas and Electricity Departments. While English coal is being exported at its present rate, with foreigners even having an eye to the possession of some of our coal mines, coal is not likely to be much cheaper. It is reported that a Scotch colliery has been purchased by a German firm of shipping agents. During June, 608,320 tons of coal were received at Hull and shipped abroad, an increase of 153,408 tons compared with June last year; while the half-year's tonnage was 2,913,648 tons, an increase of 593,840 tons. Trade in Lancashire continues very satisfactory. The pits are nearly all working full time. The miners are seeking another advance of 5 per cent. in wages, which is under the consideration of the Coal Conciliation Board. Prices show no change from the last published quotations.

Northern Coal Trade.

There has been rather more irregularity in the coal trade of late. The demand has been generally good for the season; and with a good supply of tonnage shipments are full. In the steam coal branch, there is a good general inquiry, and the trade has been brisk—the large output being well taken up. Best Northumbrian steams are from 14s. 10d. to 15s. per ton f.o.b. For second-class steams the quotation is from 14s. to 14s. 3d.; and for steam smalls the current price is 10s. to 10s. 3d. As to gas coals, the request for best qualities is full, with firm prices; but other kinds are not quite so brisk. Durham gas coals vary, according to quality, from about 13s. 3d. up to 14s. 6d. per ton f.o.b.—and occasionally to 14s. 9d. A few small contracts have been decided, but there is nothing in the quantity or price to make them important in their effect. Indeed, some of the chief of the gas-coal collieries have now the bulk of their output bespoken for some months to come, which helps to steady the prices generally. In coke, there is a fair demand; and gas coke is kept firm by the limited output. The current quotation for good gas coke is 17s. to 17s. 6d. per ton f.o.b. on the Tyne.

Scotch Coal Trade.

There is no trade report for the past week, on account of the Glasgow Exchange having been closed for the holidays. The ship-

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 221.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
268,324	10	,,	7½	Do. 7 p.c.	13¾—14¼	..	5 3 5
200,000	5	May 15	7	Bombay, Ltd.	6¾—7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	4⅞—5⅛	..	5 6 8
50,000	10	Feb. 28	14	Bourne- mouth Gas and Water } 10 p.c.	27½—28½	..	4 18 3
51,810	10	,,	7	} B 7 p.c.	16½—17	..	4 2 4
53,200	10	,,	6	} Pref. 6 p.c.	15—16	..	3 15 0
380,000	Stk.	,,	12½	Brentford Consolidated	250—255	..	4 18 1
300,000	,,	,,	9½	Do. New	188—193	..	4 18 5
50,000	,,	,,	5	Do. 5 p.c. Pref.	117—122	..	4 2 0
206,250	,,	June 13§	4	Do. 4 p.c. Deb.	100—103	..	3 17 8
220,000	Stk.	Mch. 14	11¼	Brighton & Hove Orig.	220—225	..	5 0 0
246,320	,,	,,	8¼	Do. A. Ord. Stk.	160—165	..	5 0 0
460,000	20	Apl. 11	10	British	41—43	..	4 13 0
104,000	Stk.	Feb. 28	6	Bromley, Ord. 5 p.c.	119—122	..	4 18 4
165,700	,,	,,	4½	Do. do. 3½ p.c.	90—93	..	4 16 9
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	11—11½	..	6 1 9
250,000	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
150,000	20	July 12	8½	Cagliari, Ltd.	25—27*	..	5 17 10
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11—13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	8½—9½	..	4 14 9
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96	..	4 13 9
157,150	Stk.	Feb. 28	5	Chester 5 p.c. Ord.	109—111	..	4 10 1
1,443,280	Stk.	,,	5⅛	Commercial 4 p.c Stk.	105—108	..	4 16 4
560,000	,,	,,	5	Do. 3½ p.c. do.	102—105	..	4 15 3
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	112—117	..	5 11 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	136—141	..	4 19 3
460,170	Stk.	—	5½	Derby Con. Stk.	—	..	—
55,000	,,	Jan.	4	Do. Deb. Stk.	—	..	—
486,090	10	Jan. 31	12†	European, Ltd.	23½—24½	+½	4 18 0
354,060	10	,,	12†	Do. £7 10s. paid	18—19	..	4 14 9
15,203,110	Stk.	Feb. 14	4⅗	Gas- } 4 p.c. Ord.	95—97	..	4 10 10
2,600,000	,,	,,	3½	light } 3½ p.c. max.	88—90	..	3 17 9
3,799,735	,,	,,	4	and } 4 p.c. Con. Pref.	104—107	..	3 14 9
4,193,975	,,	June 13	3	Coke } 3 p.c. Con. Deb.	82—84	..	3 11 5
258,740	Stk.	Mch. 14	5	Hastings & St. L. 3½ p.c.	95—100	..	5 0 0
82,500	,,	,,	6½	Do. do. 5 p.c.	116—119	..	5 9 3
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	15—20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental	173—176	+2	4 10 11
473,600	Stk.	Feb. 14	3½	Do. 3½ p.c. Deb. Red.	93—95	..	3 13 8
184,602	Stk.	Mch. 14	6	Lea Bridge Ord. 5 p.c.	110—120	..	5 0 0
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108—110	..	3 12 9
£			p.c.				£ s. d.
561,000	Stk.	Feb. 28	10	Liverpool United A	221—223	..	4 9 8
718,100	,,	,,	7	Do. B	164—165	..	4 4 10
144,140	Stk.	Feb. 14	7⅞	Maidstone 5 p.c.	142—147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd.	4—4½	..	5 11 1
560,000	100	Apl. 2	5	Met. of } 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	,,	4½	Melbourne } 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	May 30	3½	Monte Video, Ltd.	10½—11½	..	6 1 9
1,775,892	Stk.	Feb. 28	4½	Newc'tle & G'tesh'd Con.	108—109	+½	4 4 10
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	94—94½	−¼	3 14 1
15,000	10	Feb. 28	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
55,940	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	Apl. 26	8	Oriental, Ltd.	140—145	..	5 10 4
60,000	5	Mch. 27	7	Ottoman, Ltd.	6—6½	..	5 7 8
398,490	5	May 15	7	Primitiva Ord.	6⅞—7⅛	..	4 16 7
796,980	5	Jan. 31	5	Do. 5 p.c. Pref.	5—5¼	..	4 15 3
488,900	100	June 1	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
1,000,000	10	Apl. 26	8	River Plate Ord.	12¾—13¼	..	6 0 9
312,650	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
250,000	10	Mch. 27	8	San Paulo, Ltd.	12¾—13¼	+⅛	6 0 9
125,000	50	July 1	5	Do. 5 p.c. Deb.	48—50	..	5 0 0
135,000	Stk.	Mch. 14	10	Sheffield A	245—247	..	4 1 0
209,984	,,	,,	10	Do. B	245—247	..	4 1 0
523,500	,,	,,	10	Do. C	245—247	..	4 1 0
70,000	10	June 13	10	South African	15—16	..	6 5 0
6,350,000	Stk.	Feb. 14	5½	South Met., 4 p.c. Ord.	120—122	+1	4 10 2
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	82—84*	+1	3 11 5
201,720	Stk	Mch. 14	8	South Shields Con. Stk.	157—159	..	5 0 8
605,000	Stk.	Feb. 28	5½	S'th Suburb'n Ord. 5 p.c	117—121	..	4 10 11
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—123	..	4 1 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk	123—128*	..	3 18 2
502,310	Stk.	May 15	5	Southampton Ord.	105—110	..	4 10 11
120,000	Stk.	Feb. 28	6½	Tottenham } A 5 p.c.	123—126	..	5 3 2
398,940	,,	,,	5	and } B 3½ p.c.	100—103	..	4 17 1
137,500	,,	June 27	4	Edmonton } 4 p.c. Deb.	99—101	..	3 19 3
182,380	10	June 13	8	Tuscan, Ltd.	10¾—10⅞	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 18 0
193,742	Stk.	Feb. 28	5	Tynemouth 5 p.c. max.	106—108	..	4 12 7
30,000	Stk.	Feb. 14	8	Wands- } A 5 p.c.	—	..	—
255,636	,,	,,	6½	worth } B 3½ p.c.	131—136	..	4 15 7
75,000	,,	,,	5⅝	and } C 3½ p.c.	—	..	—
79,416	,,	June 27	3	Putney } 3 p.c. Deb. Stk	77—80	..	3 15 0
845,872	,,	Feb. 28	5½	West Ham 5 p.c. Ord.	102—105	..	4 17 7
185,000	,,	,,	5	Do. 5 p.c. Pref.	120—123	..	4 1 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk	100—103	..	3 17 8

Prices marked * are "Ex div." † Next dividend will be at this rate.

ments for the week amounted to 313,091 tons—a decrease of 24,348 tons upon the preceding week, but an increase of 38,404 tons upon the corresponding week of last year. For the year to date, the total shipments have been 7,656,677 tons—an increase of 465,906 tons upon the corresponding period of 1906.

Gas-Meter Testing in Edinburgh.

We have received from the Official Inspector of Gas-Meters in Edinburgh (Mr. William Gordon) his report on the working of the department under his control in the year ended the 15th of May last. It shows that the number of meters tested was 87,616—being 16,794 wet and 70,822 dry; and fees to the amount of £2430 were collected. The total number of meters tested by the department since its institution in 1861, up to and including the 15th of May last, was 2,167,231; the fees received for this period being £64,112. During the twelve months there were tested and examined all the gas-meters fixed at the Government Military Depôts in the Midlothian district. The circulation of the prepayment meter continues to increase; and figures are presented in an appendix showing the exact number of automatic meters tested and examined during the past year. The new automatic meters numbered 36,370, or 41·51 per cent., and those repaired 7406, or 8·45 per cent. A cash statement appended to the report shows a profit of £990 on the year's work.

Explosions in Street-Boxes.

The Highways Committee of the Wandsworth Borough Council reported on Monday last week that they had received replies to a letter written by the Town Clerk, at the instance of the Wandsworth and Putney Gas Company, on the subject of explosions caused by accumulations of gas in telephone, electric light, &c., street-boxes. The County of London Electric Supply Company, Limited, stated that they were working under Board of Trade regulations, and proposed to continue to do so, and that notice was given to the Gas Company when leakages were detected. They suggested that the Gas Company should be called upon to keep their mains in effective condition, and to give notice of the laying and alteration of mains, as is done by the Electric Supply Company with regard to their works. The National Telephone Company said the practice of filling manholes with removable material, as suggested by the Gas Company, was abandoned some years ago, and it was their practice to seal up the ends of the pipes running into manholes. They promised that the manholes in the borough should be at once inspected, to ensure that this practice was being efficiently carried out. The London United Tramways, Limited, wrote to the effect that their cables were laid on the solid system, and they did not consider it practicable to fill the street-boxes with a removable material, as suggested by the Gas Company.

Limerick in Darkness.—Owing to a strike of lamplighters at Limerick, the city was left in semi-darkness last Friday night. Unfortunately a dense fog hung over the streets, and added to the difficulty of pedestrians and others. The trouble continued on Saturday and Sunday nights.

Assessing Water Companies for Income-Tax.—At the annual conference of the National Urban District Councils' Association held last week at Ventnor, the Executive Committee submitted the opinion of Mr. Danckwerts, K.C., upon the legality of assessing water-works undertakings for income-tax upon profits. He upheld the arguments of the surveyors of taxes that a water-rate chargeable only upon consumers was a non-compulsory rate and therefore liable to assessment; and he stated that only the receipts from compulsory rates were untaxable.

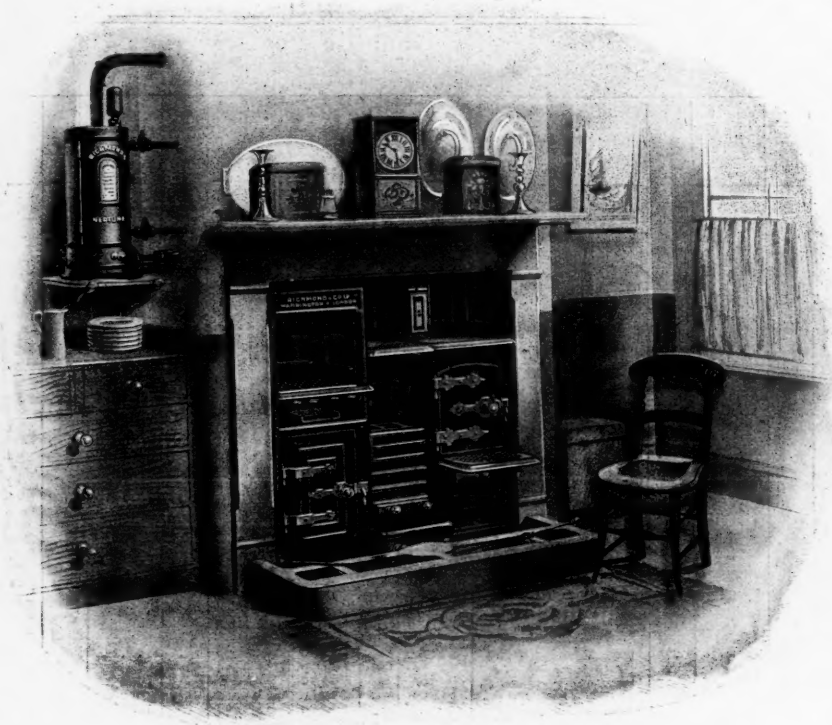
Additional Capital for the Uxbridge Gas Company.—At the Mart, Tokenhouse Yard, E.C., last Wednesday, Mr. Alfred Richards offered for sale, under instructions from the Directors, a new issue of £6000 of consolidated stock of the Uxbridge Gas Company, under the provisions of their Act of last session. The stock ranks for a standard dividend of 5 per cent., subject to the sliding-scale; and it is entitled, in view of the dividends last paid by the Company, to 4¼ per cent. per annum. It was sold at prices ranging from £86 to £87 per £100; the purchasers taking the dividend accruing from the 31st prox.

Gas-Meter Testing at Reading.—The Inspector under the Sales of Gas Acts to the Corporation of Reading (Mr. Henry Wright) has presented to the Highways and Lighting Committee his report for the year ending the 31st of March last. In this period he had 1050 meters submitted to him; 523 being 5-light, 367 10-light, 105 20-light, and the remainder ranging from 30 up to 150 lights. The meters were tested, and 1029 were found correct and were stamped, while 21 were rejected. Of those stamped, 284 were absolutely correct, 655 averaged 0·91 per cent. slow, or in favour of the consumer, and 111 were 0·75 per cent. fast, or against the consumer. Mr. Wright considers that this is a very satisfactory result. Sixteen meters were submitted for special testing in disputed cases by the Reading Gas Company, and four by the Goring Gas Company; and certificates were given in all cases.

Conservation of Catchment Areas.—At the recent congress of the Royal Institute of Public Health, held at Douglas (Isle of Man) under the presidency of Lord Raglan, a paper, entitled "Some Notes on Water Supplies from Catchment Areas," was read by Mr. Thomas Duncanson, M.Inst.C.E., the Assistant Water Engineer to the Liverpool Corporation, who said if the population of England continued to increase at the rate it had done of late years, it would be absolutely necessary that large areas of country should be set apart for the supply of water—"water farms," in fact—to be kept free from agricultural manure and other contaminations. The purchase of catchment areas by water authorities, the cessation of the cultivation of arable land on them, planting in connection with afforestation, and the general use of the catchment areas as sporting and grazing lands, were all steps towards the production of the "water farm," which, as its chiefest product, should aim at producing pure water.

Hot Water Difficulty Solved!

Can we supply you with our "NEPTUNE" Booklets, for counter use, etc.?



View of Kitchen showing Richmond's "NEPTUNE" Heater fitted to existing hot-water circulating system.

Advertisement of the RICHMOND GAS STOVE & METER CO., LTD.

London Offices and Show-Rooms: 132, Queen Victoria Street, E.C. General Offices and Works: Warrington, &c.

Selby's New Water-Works.

Last week the "Globe" published an article entitled "Selby Abbey Revisited;" and this led Mr. Percy Griffith to write to our contemporary for the purpose of pointing out that, beyond the provision now being made by the Abbey authorities for the insurance of the renovated structure [the disastrous fire which occurred last year will be remembered], the Selby Urban District Council are providing a more effective insurance against fire than any fire policy. "I refer," he continues, "to the new water-works which will be inaugurated before the end of the year. In this scheme (for which, in conjunction with Mr. Bruce Gray, the Council's Surveyor, I am acting as Engineer) is included a reservoir containing 800,000 gallons of water and situated on the summit of 'The Barff,' a hill some 140 feet above the surface level in the Abbey precincts. The pressure available from this reservoir will be sufficient to throw a powerful jet of water well above the central tower of the Abbey, without the intervention of any fire-engine whatever; and as a large number of hydrants are already fixed around the Abbey with hose, jet, and all accessories available at a moment's notice, it is almost beyond the range of possibility that this unique and priceless structure can again become a prey to the devouring flames as it was in October last. As 'prevention is better than cure,' so I may reasonably describe this mode of insurance as being more effective than any financial provision, which can only avail after irreparable damage has occurred."

Lead Wool Joints for Gas-Pipes.—We are informed that, as the result of a number of tests, the Consolidated Gas Company of New York have placed with the Lead Wool Company a contract for 100 tons of lead wool, and are now laying considerable quantities of 36, 30, and 24-inch mains, all the joints of which are made with this material.

Suicide by Gas.—By committing suicide while in a very depressed state, for which he was being medically treated, Mr. Thomas Heath, of Penarth, has cut short an artistic career of great promise. Deceased, who was only 31 years of age, and had exhibited various pictures at the Academy, was found dead near an india-rubber tube, the other end of which was over a gas-jet, which was turned full on. He had long suffered from bad health.

Teignmouth in Darkness.—Soon after ten o'clock on Monday night last week, the gas supply in Teignmouth was suddenly cut off. In the absence of the Manager (Mr. J. A. Gray), who was away on holiday, the Chairman of the Gas Committee of the Urban District Council (Mr. W. J. B. Banbury), immediately proceeded to the gas-works, and found that the bell of the governor connected with one of the holders had gone wrong through the valve not acting. This was quickly rectified, and the supply restored in about 15 minutes.

Cost of the London County Council's Electricity Bill.—At the meeting of the London County Council last Tuesday, Mr. N. L. Cohen asked the Chairman of the Parliamentary Committee if he could inform the Council what had been the cost to London of promoting the Council's Electricity Supply Bill, which had been thrown out by a Committee of Parliament. Mr. W. Peel said he could not give the exact figure; but he thought it would be about £8500. The sum of £18,000 had been provided in the estimates for the costs of the measure. He added that they had lost the Bill, but they had saved their money.

Arbitration as to a Reservoir Site.—At the Surveyors' Institution a few days ago, arbitration proceedings were held to determine the amount to be paid to Mr. Deakin for 64 acres of land which the Bolton Corporation propose to acquire for the purposes of a reservoir. Sir E. Boyle was Arbitrator for the claimant, and Mr. G. H. Hill for the Corporation; Mr. A. E. Fair being the Umpire. The amount given by the claimant's witnesses was about £19,700; Mr. James Watson, of Bradford, for the Corporation, put the full value at £3213, and the other witnesses at something between this and £4000, on the ground that the land was only agricultural. The award was reserved.

"Everybody uses gas-stoves nowadays, and there is no use for us," said a sweep at the Brompton County Court a few days ago.

According to the "Daily Express," Mr. C. Snelling, the Manager of the Thetford Gas-Works, while digging in his garden, uncovered an ancient coffin of Ancaster or Barnet stone. The lid was 6 inches thick, and bore a carved cross; and the coffin contained the complete skeleton of a man 6 ft. 2 in. tall.

Last Saturday week, the Fittings Department of the Wolverhampton Gas Company had their annual outing; the destination being Portsmouth and the Isle of Wight. After dinner at the former place, a vote of thanks was passed to the Gas Company for the treat, and to the Manager (Mr. P. G. Winstanley) for his kindness to the men.

There was an electric light failure—happily of only short duration—at Tunbridge Wells last week. Both indoor and outdoor lights were affected; and at the Opera House, the management had good reason to congratulate themselves on their foresight in having provided gas-jets "in readiness for emergencies." On the Pantiles, a minimum amount of inconvenience was experienced, as gas is there used for street lighting purposes.

We learn that the Thwaite patent tar road-surfacing machines are to be employed on the roads in different parts of the country with the view to the prevention of dust. The machine has already afforded proof of its value in Derbyshire, Lincolnshire (it was applied to the processional roads to the Royal Show at Lincoln), Berkshire, and Surrey. The machine is self-contained; and the tar is applied at a high temperature.

Messrs. Joseph Taylor and Co. have received an order for saturators, together with sulphate-drainer, acid-tanks, sulphate-stores, &c., in connection with sulphate plant which is about to be erected for the Dumfries Corporation Gas Department and the Shanklin Gas Company. The firm have also received orders for a complete plant, including stores, saturator, lining of foundation, &c., for the Horley Gas Company. A further repeat order has been received for three solid plate lead saturators, fitted with duplicate ammonia and acid pipes, for Australia, ordered by Messrs. John Terry and Co.

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COTTAGE LANE, CITY ROAD, LONDON.

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LEAFLETS FOR DISTRIBUTION.

"ILLUMINATING TRUTHS FOR HOUSEHOLDERS."

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.

Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

GAS ENGINEER AND MANAGER. Morecambe Corporation. Applications by July 25.
WATER-WORKS INSPECTOR. "J.," Victoria Street, S.W.

Situations Wanted.

ENGINEER (DANISH) IN CONVEYOR AND TRANSPORT WORKS. No. 4800.
GAS AND WATER ENGINEER. No. 4798.
MANAGER OR MANAGER AND SECRETARY. No. 4801.
REPRESENTATIVE. H. Classing. Loughborough Road.

Patent for Disposal.

COMPRESSED GAS. Rosenberg and Goldschmidt, Hamburg.

Tar Works for Sale. No. 4799.

Plant (Second-Hand), &c., for Sale.

GAS ENGINE, &c. "G. S.," c/o West End Advertising Agency.
ENGINE AND PUMPS. No. 7854, c/o J. W. Vickers & Co.

Plant (Second-Hand) Wanted.

SCRUBBERS AND WASHERS. "Gas-Works," c/o Vickers.
CONDENSER, EXHAUSTER, SCRUBBER, WASHER, AND PURIFIER, &c. No. 4797.

Company Meetings.

BRENTFORD GAS COMPANY. Westminster Palace Hotel. Aug. 2. 2.30 o'clock.
BROMLEY GAS CONSUMERS' COMPANY. Bell Hotel, Bromley. Aug. 13. Six o'clock.
GASLIGHT AND COKE COMPANY. Chief Office. Aug. 2. Twelve o'clock.
SOUTH METROPOLITAN GAS COMPANY. Cannon Street Hotel. Aug. 14. Two o'clock.
SOUTH SUBURBAN GAS COMPANY. De Keyser's Hotel. Aug. 9. Three o'clock.

Prospectus.

BAHIA BLANCA GAS COMPANY.

TENDERS FOR

Coal and Cannel.

BATLEY GAS DEPARTMENT. Tenders by Aug. 12.
COCKERMOUTH GAS DEPARTMENT. Tenders by July 29.
EAST RETFORD GAS DEPARTMENT. Tenders by Aug. 3.
STRATFORD-ON-AVON GAS DEPARTMENT. Tenders by Aug. 17.

Gasholder and Tank.

THURLES GAS COMPANY. Tenders by July 29.

Pipes and Specials.

COVENTRY WATER DEPARTMENT. Tenders by July 30.
RADCLIFFE AND PILKINGTON GAS COMPANY. Tenders by Aug. 6.

Tar and Liquor.

RHYL GAS DEPARTMENT. Tenders by July 31.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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